Larson Systems Inc.

UT User Manual

Universal Testers - UT 11, UT 24, UT 25, & UT 36

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LARSON SYSTEMS INC.

UT 11, 24, 25 & 36 - SERIES

UNIVERSAL TESTER

User Manual

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This manual could contain technical inaccuracies or typographical errors. Changes are periodically made to the information herein. These changes will be incorporated in new editions of the manual

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1.0 About the Universal Tester System

1.1 Description - What it can do.

The UT 11, UT 24, UT 25 and UT 36 series of Universal Testers are stepper motor-driven testers that allow the operator to enjoy simple, accurate testing capabilities with many built in features. The Universal Tester system is available in four length displacements with five different software package options. The UT 11 has an 11-inch maximum length displacement, or stroke. The UT 24 has a 24-inch stroke, the UT 25 has a 25-inch stroke and the UT 36 has a 36 in stroke. The UT-11 Universal Tester is pictured below.

1.2 Standard Features

The following features are standard on all Universal Tester systems:

- Emergency stop and start button
- Safety shield and through-rod capability for operator protection
- Compression testing
- Manual and programmed testing modes
- 4 jog buttons, 2 up and 2 down
- Upper and lower platforms
- Interchangeable Load Cell (One Load Cell is included with the order.)
- Length measurement accuracy of ±0.001” with a 0.0004” resolution
- Force measurement accuracy of ±0.1% of the selected load range
- Selectable measurement units
- Force at length measurement
- Length at force measurement
- Programmable force and length
- Multiple test points
- Test point commands: <Jump to>, <Insert> and <Delete>
- Tare weight capability
- Manual and programmable abort feature to stop a test in mid-test
- LED (light emitting diode) information screen and LED indicator lights
- Auto-Load Ranging – Automatically switches load range at 20% of full scale (The lower range of 0 – 20% has ten times the resolution as the upper range.)

1.3 Options

The following optional hardware items are also available through LSI:

- Printer and connecting cable with printer buffer for faster testing
- Guide pins and rods to protect from buckling springs
- Calibrated Load Cell (weight kit) and force meter (N.I.S.T. traceable)
- Extension cable and calibration manual
- High resolution length scale: 0.0001 inch resolution, 0.0005 inch accuracy
- Extension hooks (100 lb., 500 lb. and 1000 lb. capacity) for extension testing
- Wire clamping fixtures
- Foot Switch for hands free operation (automation interface required)
- Dust Cover

1.4 List of Software Features

The following chart lists the various features in each of the five optional software packages that are available from LSI (B = Bronze, S = Silver, G1 = Gold 1, G2 = Gold 2, P = Platinum)

	B	S	G1	G2	P	Description
Features	X	X	X	X	X	Thru-Rod: Test buckling springs up to 1-3/8 and 6-1/8 inch diameters on some models
	X	X	X	X	X	Jog Switch: Five-position for accurate length positioning
	X	X	X	X	X	Manual Testing Mode: Select desired test lengths and forces
	X	X	X	X	X	Compression Testing: Perform compression tests per user defined specifications
	X	X	X	X	X	Manual Abort: Manually stop a test in mid-test
			X	X	X	Programmed Abort: Stop a programmed test in mid-test based on tolerance of a particular test point
		X	X	X	X	Extension Testing: Perform pull tests per user defined specifications
				X	X	Force/Length Offset: Program desired force/length offset during test
				X	X	Speed: 0-15 in./min. with full force capacity or 0-120 in./min. w/ reduced force capacity
Test Functions	X	X	X	X	X	Force @ Length Testing: Measuring force at a given length
	X	X	X	X	X	Length @ Force Testing: Measuring length at a given force
		X	X	X	X	Spring/Multiple Rate: Calculated between any two test points
			X		X	Presetting (Scragging): Exercise springs prior to testing
			X		X	Free Length Measurement: Measure compression spring free length
			X		X	Initial Tension Measurement: Measure load requirement for coil separation on extension springs
				X	X	Pause: Stop test sequence until operator resumes
				X	X	Delay: Program timed delays between test points
				X	X	Multiple Peak Force: Program the peak force a multiple number of times during same test
Computer Control	X	X	X	X	X	RS 232: Printing/Data Communications Port to UTM PC package
	X	X	X	X	X	English/Metric Units: Select from lb./in., N/mm, g/in., g/mm or oz./in.
	X	X	X	X	X	Absolute Programming: Program lengths/forces relative to the zero length/force reference point
			X	X	X	Incremental Programming: Program lengths and forces relative to the previous test point
	X	X	X	X	X	2-Point Testing: Up to 2 test points per test
		X	X	X	X	10-Point Testing: Up to 10 test points per test
			X	X	X	99-Point Testing: Up to 99 test points per test
			X		X	99-Point Preset Cycle Testing: Exercise springs up to 99 times
					X	10,000,000-Point Preset Cycle Testing: Exercise springs up to 10,000,000 times
			X	X	X	Save & Retrieve Memory: Up to 300 headings and 1300 test points
		X	X	X	X	Global Conditional Testing: Print/display results as Good or Bad based on tolerance for each test point
			X	X	X	Individual Conditional Testing: Print/display results as Good, Bad High, or Bad Low for each test point
		X	X	X	X	Printing: Print in Manual format, Report format, Data Logger format, and Heading format
		X	X	X	X	Personalized Report Heading: Personal report information
			X	X	X	Sorting software: Requires optional automation interface or 3-way sorter
Load Measurement	X					Single load cell capability
		X				2 Interchangeable load cell capability
			X	X	X	6 Interchangeable load cell capability
	X	X	X	X	X	Push Button Zeroing: Tare out loads up to load cell capacity
	X	X	X	X	X	Auto-Load Ranging: Auto shift between 0-20% and 20-100% of full capacities
	X	X	X	X	X	20-bit internal force resolution
	X	X	X	X	X	Deflection Compensation: Load cell & frame

1.5 Safety and Use Considerations

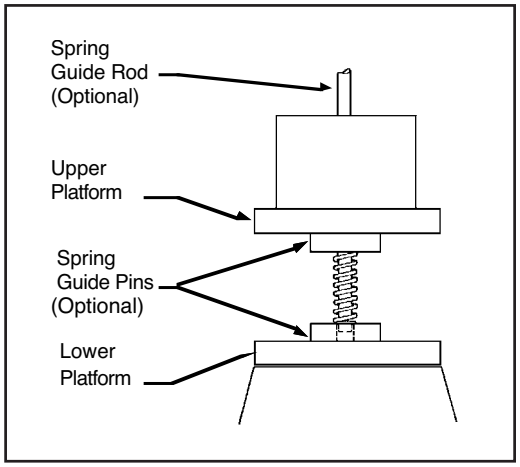
Caution: A compressed or extended spring has stored potential energy. Use care to release this energy in a controlled manner to avoid possible injury.

1.5.1 Eye Protection - The operator must wear eye protection when near or using the Universal Tester. An exception can be made when a guard is used to confine the spring to the test machine area.

1.5.2 Starting and Stopping - The Universal Tester has a start test button located on the data panel. To start each automatic test, press the start test button. The Tester also has a Start and Emergency Stop Button (Start/Stop Button). Turning the switch clockwise will turn on the power to the Tester. Pressing the button turns off power, which stops the drive motor and extinguishes the LED Display and all indicator lights.

Caution: If the upper platform is applying force on a test spring when the Universal Tester is turned off, the Tester's upper platform remains in its current position. This action can cause a hazard particularly if the test spring is in high tension. Make certain the face shield is installed on the Tester.

1.5.3 Guide Pins and Guide Rods -
LSI STRONGLY RECOMMENDS the use of the guide pins or the guide rod for any springs that may have a tendency to buckle or collapse during testing. Without the guide pins or guide rod the test spring may release from between the test platforms and could cause injuries. When in doubt use the guide pins and/or guide rods as shown in the figure to the right. The guide pins and guide rods are available from LSI.



1.5.4 Load Cell Protection - During normal testing modes (manual or programmed), the Tester monitors the load cell reading and will not permit an overload to occur. However, in the Calibrate mode, IT IS POSSIBLE TO OVERLOAD THE LOAD CELL! Load cell monitoring will continue in the calibrate mode. If the load cell is overloaded, an error code (E04) appears on the display and an alarm will sound to alert the user to the overload.

Note: Larson Systems, Inc. is not responsible for damaged load cells due to overload.

1.6 Specifications

Length Specifications								
	UT-11		UT-24		UT-25		UT-36	
	in.	mm	in.	mm	in.	mm	in.	mm
Range	12	305	12	305	24.5	620	36	914
Resolution (standard scale)	0.0004	0.01	0.0004	0.01	0.0004	0.01	0.0004	0.01
Accuracy (standard scale)	± 0.001	± 0.03	± 0.001	± 0.03	± 0.002	± 0.05	± 0.002	± 0.05
Resolution (high resolution scale)	0.0001	0.003	0.0001	0.003	0.0001	0.003	0.0001	0.003
Accuracy (high resolution scale)	± 0.0005	0.015	± 0.0005	0.015	± 0.002	± 0.05	± 0.002	± 0.05
Deflection Compensation (measured w/ 0.1in. gauge block at 5%-95% of full scale)	< 0.001	< 0.03	< 0.001	< 0.03	< 0.001	< 0.03	< 0.001	< 0.03
Parallelism (* measured at 4 corners at 2.00 in. with 200 lb load) (** measured at any length with 200 lb load)	0.001 TIR	0.03 TIR	0.001 TIR	0.03 TIR	0.002 TIR* 0.004 TIR**	0.05 TIR* 0.1 TIR**	0.003 TIR* 0.005 TIR**	0.08 TIR* 0.13 TIR**

Force Specifications (Load Cell Resolutions)							
Load Cell	**2 lbs.** 8.8 N 0.9 kg	**11 lbs.** 48 N 4.9 kg	**22 lbs.** 97 N 9.9 kg	**66 lbs.** 293 N 29 kg	**110 lbs.** 490 N 50 kg	**200 lbs.** 889 N 90 kg	**550 lbs.** 2,455 N 250 kg
lb	0.0001	0.0002	0.0005	0.001	0.002	0.005	0.01
N	0.0002	0.001	0.002	0.005	0.01	0.02	0.05
g	0.02	0.1	0.2	0.5	1	2	0.005
Load Cell	**1,000 lbs.** 4,448 N 453 kg	**2,000 lbs.** 8,896 N 907 kg	**3,000 lbs.** 13,344 N 1360 kg	**10,000 lbs.** 44,482 N 4,535 kg	**20,000 lbs.** 88,965 N 9,071 kg	**50,000 lbs.** 222 KN 22,678 kg	Accuracy = ± Resolution x 2 Resolution is display limited to XXXX.X
lb	0.02	0.05	0.1	0.2	0.5	5	
N	0.1	0.2	0.5	1	2	0.02	
kg	0.01	0.02	0.05	0.1	0.2	2	

2.0 Initial Set Up

2.1 Unpacking

Remove the unit carefully and check the contents with the enclosed packing list. Confirm that all items ordered are received. The warranty is in the User Manual (Section 9.0) and has space to record the model designation, serial number and the date of receipt of the Tester. Make these entries at once.

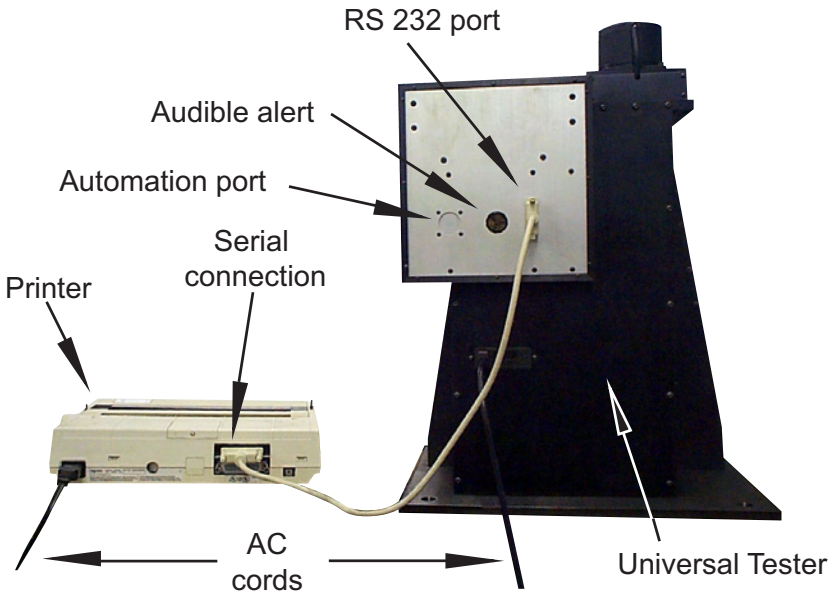
2.2 Setting Up the Tester

Place the Universal Tester on a level and stable work area where the user can perform the testing in a comfortable manner. (The lower platform should be at a height to allow ease in loading, testing and removing testable items and the displays should be easy to see.) The UT 25 and UT36 Testers must be leveled using a precision level placed on the base plate. The leveling feet must have equal pressure. The Universal Tester requires 1.5 amps of electrical power from a 50/60 Hz outlet. The Tester will require a 110-volt or a 220-volt outlet, depending on how the Tester was configured.

2.3 Data Acquisition

Data from the Universal Tester may be collected onto a printer, a computer or other data collection system through the Tester's RS 232 port. The Tester has a built-in computer that stores the current test data and the statistical summary information from each test cycle at the end of each test series. Printing test data from the Tester to the printer eliminates manual data entry (and data entry errors) and provides a hard copy for comparison, reference and storage.

Data from the Tester may also be collected onto a computer with Windows 95 - 98 operating system. The LSI Universal Testing Manager (UTM) program software (available from LSI) is required for data collection on the computer. The user can download test data for storage, retrieval and statistical analysis. The user can also retrieve test parameters for faster set-up and standardized testing procedures.



2.4 Printer Installation

The printer is packaged independently of the Tester. Place the printer next to the Tester or in a convenient spot in close proximity to the Tester. Connect the printer to the Tester by connecting the interface cable from the serial connection on the printer to the RS 232 port on the Tester (as shown in the figure on the previous page). Connect the printer to an appropriate outlet (110 or 220 VAC) using the power cord.

2.4.1 Operational Controls - The following are the basic operational controls for the printer. For more detailed information consult the manufacturer's handbook included with the printer.

ON / OFF Switch - Turns printer on or off.

Paper Lock Release Lever - This lever has two positions:
1. Back for friction feed of paper in roll form or individual sheets.
2. Forward for sprocket drive of pin-fed paper.

Platen Knob - Allows the operator to feed paper manually

Select Switch and Light - Turns the printer receiving system on and off. This switch has an indicator light. When the Select Switch and light are on, the printer is ready to receive data. When the Select Switch and light are off, the following three switches are operable:

1. TOF: Sets the position on the page for the first line of print.
2. Line Feed: Prints and feeds the paper one line at a time.
3. Form Feed: Prints and feeds the paper to the top of the next page.

Please Note: If the Select Light goes out while printing, press the Form Feed switch to print the output that remains in the printer's memory.

2.4.2 Loading Paper - Remove the access cover and manually insert and align the paper under the paper bail. After inserting the paper, press the paper lock release lever forward to confine the paper. Turn on the printer and confirm that the paper was properly inserted by pressing the Line Feed button. Adjust for the desired TOF set position.

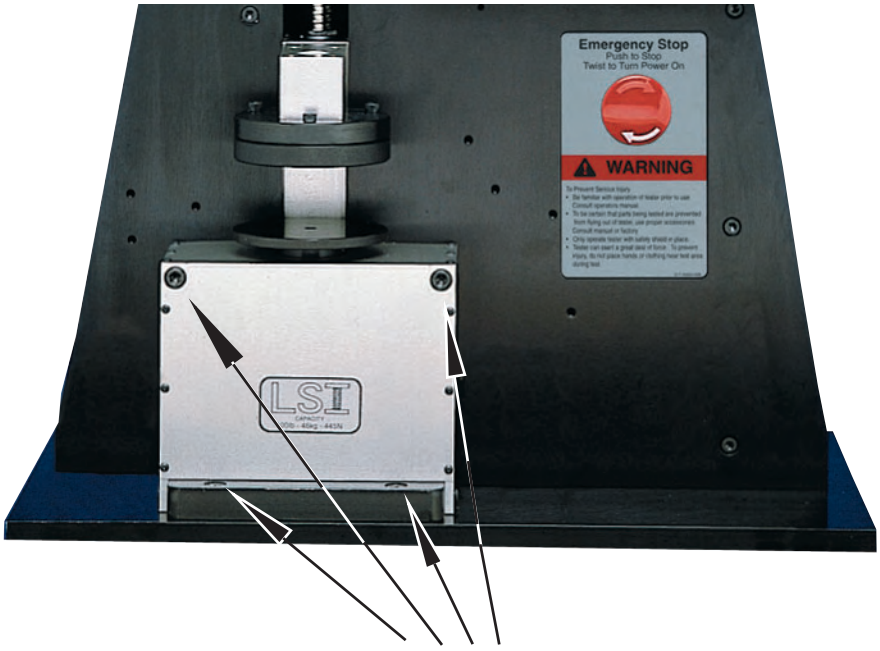
2.4.3 Printer Alarm - The Alarm Light goes on when the printer is out of paper or when there is a motor alarm error. The printer remains inoperable until the alarm condition is corrected.

2.4.4 Printer Ribbon Replacement - Turn off the power and remove the access cover: remove the used Ribbon Cartridge and replace with a new one. Replace the access cover and turn on the printer.

2.5 Changing the Load Cell

> ***Note: Before changing the Load Cell, power-down the Tester by pressing the Start/Stop Button.***

The Load Cell is located on the front of the Tester under the lower platform. A variety of Load Cells ranging from 2-lb. to 20,000-lb. capacity are available from LSI. The Load Cell is held in place on the Tester with four (or six) large cap screws. The numerous small cap screws hold the Load Cell together. Each Load Cell is a complete assembly and it is unnecessary to disassemble the unit to change to a different load rating.



Locations of the four capscrews

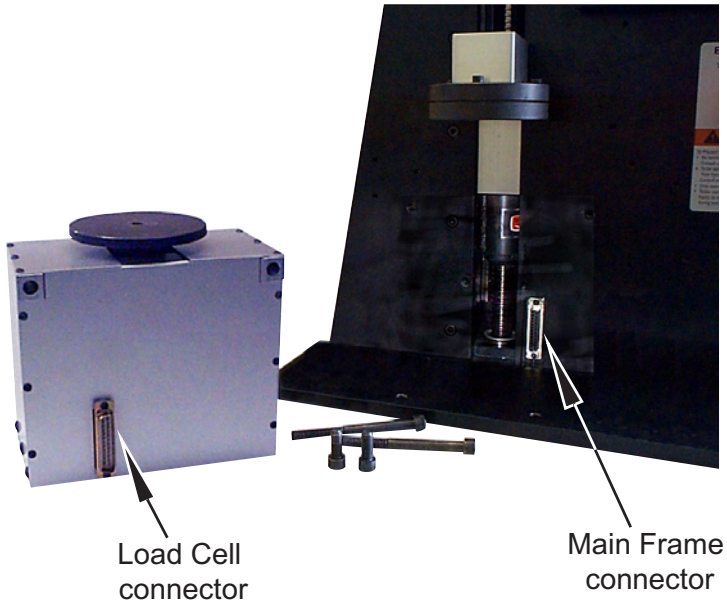
2.5 Changing the Load Cell (continued)

2.5.1 Load Cell Removal

1. First, remove the large cap screws that hold the Load Cell onto the BASE the Tester.
2. Next, remove the large cap screws that hold the Load Cell to the rear VERTICAL SUPPORT MEMBER.
3. Exercise care and slide the Load Cell forward and away from the vertical support member to disconnect the Load Cell connector.

> ***Note: Exercise care when removing the Load Cell. The Cell can scratch the surface of the base, which could cause possible errors in parallelism measurements for subsequent re-installed Load Cells.***

4. After the Load Cell and main frame connectors are fully disengaged, lift the Load Cell and remove it from the Tester. Store the Load Cell in a suitable protective place.



2.5.2 Load Cell Installation

1. Place the Load Cell on the base of the Tester with the Load Cell connector lined up with the main frame connector.
2. Exercise care and slide the Load Cell toward the main frame so that the connectors are fully engaged and the Load Cell is snug against the main frame.
3. Install the top two large cap screws, then the lower two (or four) large cap screws and tighten until the bolts are snug.
4. First, tighten the **TOP TWO** cap screws to 10 ft.-lb. torque using a torque wrench. Do not over-tighten.
5. Next, tighten the **BOTTOM TWO** (or four) cap screws to 10 ft.-lb. torque using a torque wrench. Do not over-tighten.

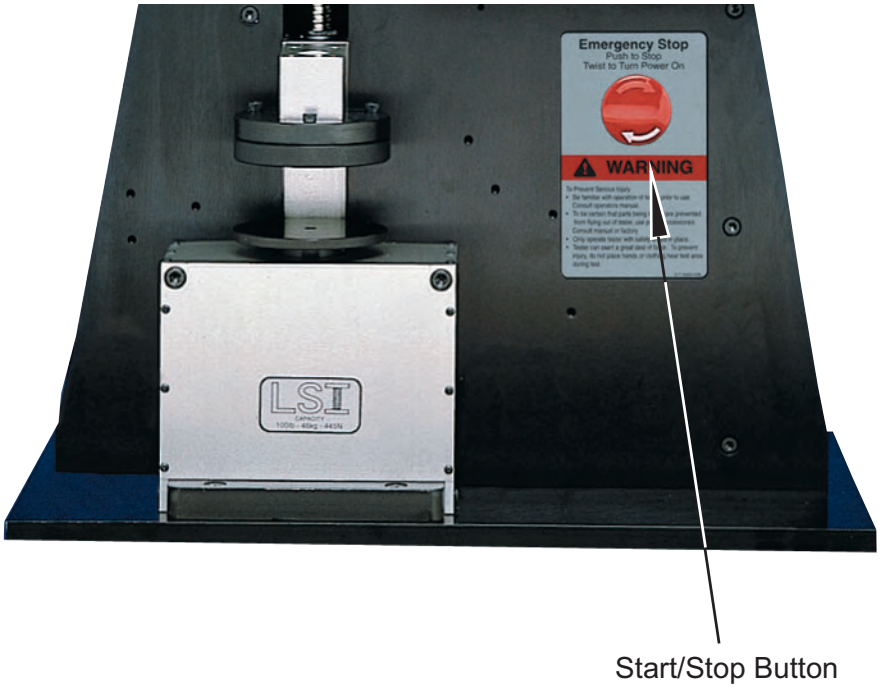
3.0 Features and Controls

3.1 Start/Stop Button

The figure below shows the location of the red Start and Emergency Stop (Start/Stop) button. Turn the Start/Stop button clockwise to turn on the power. The fan starting and a self-test of the Data Screen and the LED lights verify power to the Tester. During the start-up procedure, the Tester goes through a self-diagnostic test of the computer RAM, program memory, Data Screen, LED lights and the audible alert. The Diagnostic Manual explains all of the internal tests that occur during start-up. For best results, the Tester should be energized for about 30 minutes to ensure stability and obtain optimal results. To turn off the Tester, push the Start/Stop button. This action will power-down the motor and extinguish the display.

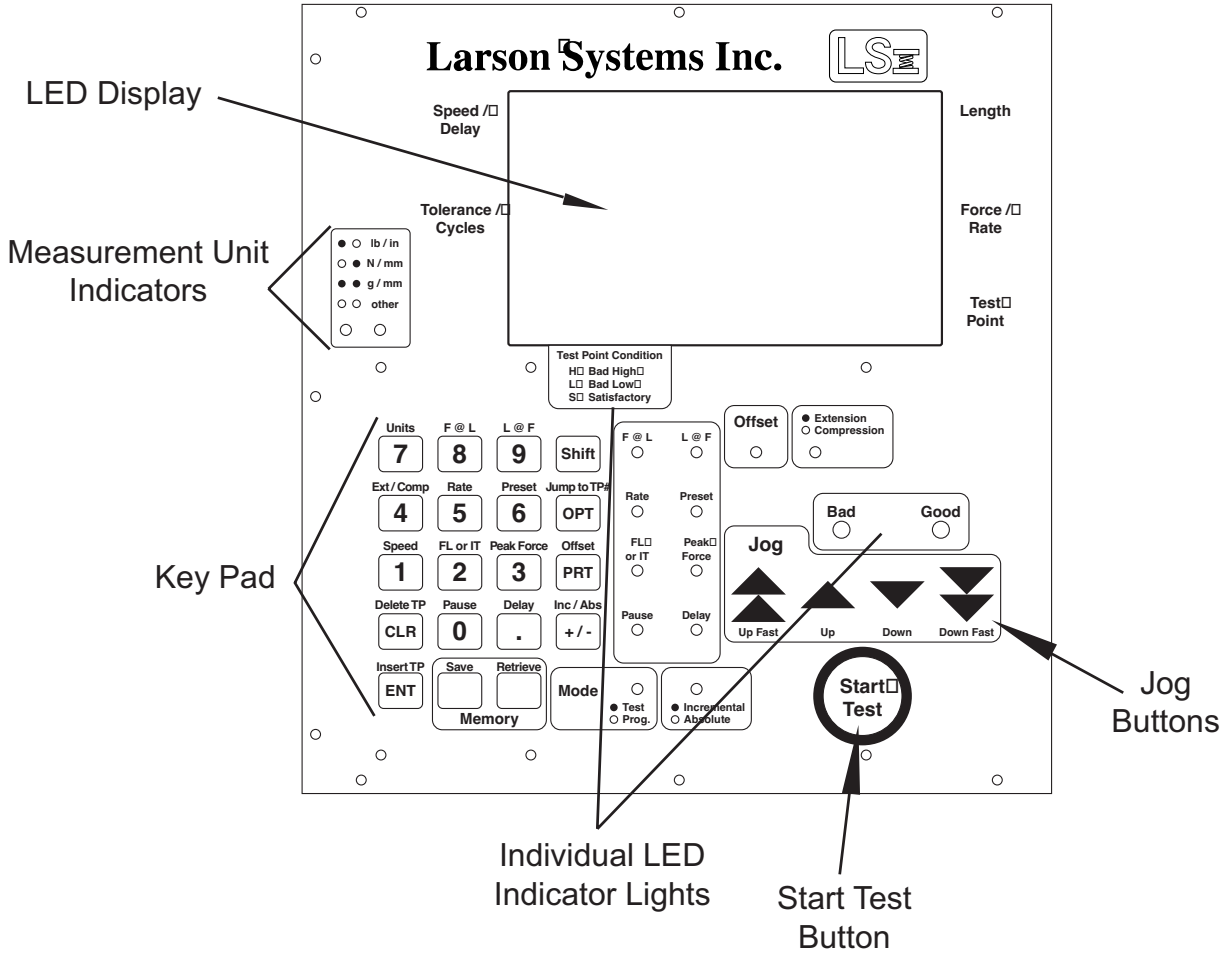
3.2 Start Test Button

The Start Test Button is located on the Data Panel in the lower right corner. To start each automatic test, press the Start Test Button.



3.3 Data Panel

The Data Panel is pictured below and shows the location of the major parts of the Data Panel including the Start Test Button, Jog Buttons, the LED Display, the Individual LED Indicator Lights and the Numeric Keypad.



3.3.1 Jog Buttons - The Jog Buttons (located in the lower right corner of the Data Panel) controls the upper platform. The Jog Buttons are operational during the Test mode but not during the Program mode. There are 4 Jog Buttons, Up Fast, Up, Down, and Down Fast.

Up Fast - Press to move the platform up in the “Fast” speed.

Up - Press to move the platform in the up direction in the “Slow” speed.

Down - Press to move the platform down in the “Slow” speed.

Down Fast - Press to move the platform down in the “Fast” speed.

Manual Abort - The Jog Buttons can also abort the programmed test that is currently running. The user may do this by pressing one of the Jog Buttons. This action will immediately stop the test at the current Test Point.

3.3 Data Panel (continued)

3.3.2 LED Display - The LED Display is a large 3 in. x 5 in. black display that has six red LED (Light Emitting Diode) clusters for an easy read-out of programming parameters and test conditions. The figure below shows the LED Display along with the Shift Key LED Indicator. The Shift Key LED Indicator tells the user if the <Shift> key has been pressed. In the Program mode, the LED Display will flash either zeros or dashes. The zeros indicate that a numerical input is required. The dashes indicate that a numerical entry is optional and the user may pass to the next entry. The six clusters are identified by the titles around the LED Display. The clusters are defined as follows.

Length	Distance of the upper platform above the lower platform
Force/Rate	Load Cell Force and Spring Rate (force/unit length)
Test Point	Programmed Test Point being evaluated
Tolerance/Cycles	Specified Tolerance or # of cycles for preset testing
Speed/Delay	Upper platform speed or programmed time delay
T. P. Condition	Evaluation of Test Point being measured (H- Bad High, L - Bad Low, S - Satisfactory)

Shift Key LED Indicator

3.3 Data Panel (continued)

3.3.3 Individual LED Indicator Lights - (See figure below.) The display panel has a number of single LED indicator lights which verify the various functions and operations selected during programming. Some lights are single function indicators while others are dual function.

The single function lights are listed below. (The functions for each of these lights are defined in section 3.3.4.)

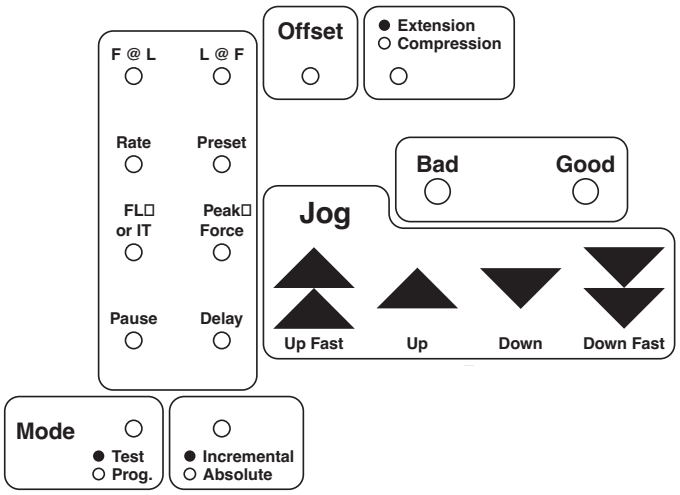
F@L	Indicates Force at Length measurement
L@F	Indicates Length at Force measurement
Rate	Indicates Spring Rate (force/unit length)
Preset	Indicates the Preset function
F.L or I.T.	Indicates Free Length or Initial Tension
Peak Force	Indicates the Peak Force
Pause	Indicates a pause step in a program
Delay	Indicates a delay step in a program
Offset	Indicates a zero Force or Length at a selected point
Bad	Indicates at least one bad Test Point
Good	Indicates all Test Points are good

The dual function lights are listed below. (The functions for each of these lights are defined in section 3.3.4.)

Mode - (Located to the right of the Mode key) - Selecting “Test” mode turns the light ON while selecting “Program” mode turns it OFF.

Incremental and Absolute - (Located to the right of the Mode light) - Selecting “Incremental” turns the lamp ON while selecting “Absolute” turns it OFF.

Extension and Compression - (Located to the right of Offset light) - Selecting “Extension” turns the lamp ON while selecting “Compression” turns it OFF.



3.3 Data Panel (continued)

3.3.4 Key Pad - The Key Pad (see figure below) is used for entering data to the system and operating the program controls. The keys and their functions are described below.

"0 - 9", " . " and "+/-" (black) - These keys are used for numerical entry.

"0" - The zero key is also used in the Test mode to zero the Force.

"+/-" - This key is also used in the Test mode to enter the "E - P -" mode (see section 5.1).

Mode Key - The Mode key switches the system between Test mode and Program mode. Section 3.7 further explains how to switch between the Test and Program modes.

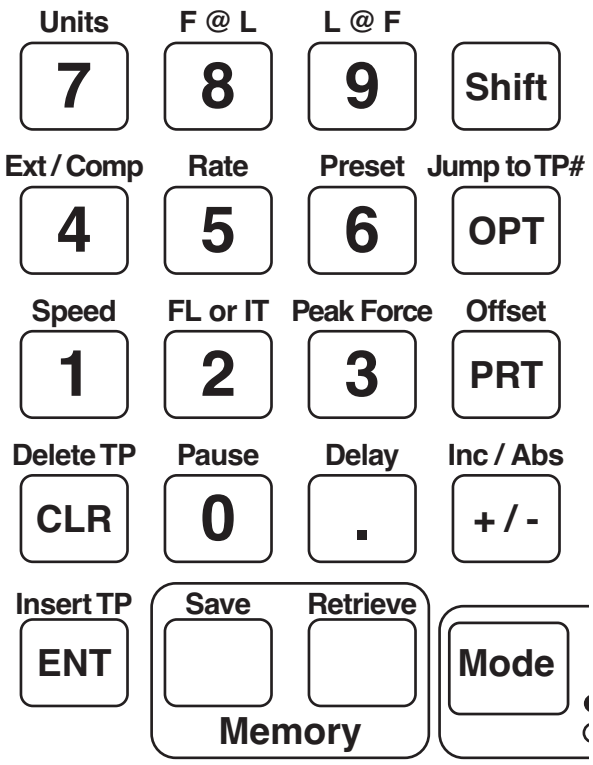
Shift Key - The Shift key is used to select the second function printed above each black data entry key. An audible alert also "beeps" when the Shift key is pressed.

Memory Save Key - The Memory Save key is used to store programming steps. See section 5.3.1. for more information on the use of this key.

Memory Retrieve Key - The Memory Retreive key is used to retrieve programming steps. See section 5.3.2. for more information on the use of this key.

OPT - The Option key is used to introduce individual test specifications and sorting options. See section 5.2 for more information on the use of this key.

PRT - The Print key actuates the printer to print the display or the entered specifications. See sections 3.8 and 5.1.1 for more information on printing.



CLR - The Clear key clears the previous entry.

ENT - The Enter key enters the displayed value into the program memory and advances through the program steps in the Program mode. This key also advances through the Test Points of a programed test immediately after the test has run.

Measurement Units (<shift> <7>) - The default setting is pounds and inches (lbs./in.). See sections 5.1.3 and 5.1.4 to review or change the Measurement Units.

F@L (<shift> <8>) - The Force at Length key is used in the Program mode. This key will tell the Tester to display a force at a particular spring length. See section 4.3 "Force at Length Test" for an example of the use of this function.

L@F (<shift> <9>) - The Length at Force key is used in the Program mode. This key will tell the Tester to display the spring length at a particular force. See section 4.4 "Length at Force Test" for an example of the use of this function.

3.3 Data Panel (continued)

3.3.4 Key Pad (continued)

Ext/Cmp (<shift> <4>) - The Extension/Compression function switches between the Extension and Compression modes. The default mode is Compression.

Rate (<shift> <5>) - The Rate key is used in the Program mode. This key will tell the Tester to calculate the Spring Rate (force/unit length). See section 4.9 “Two Point Conditional Force @ Length and Spring Rate Test” for an example of the use of this function.

Preset (<shift> <6>) - The Preset key is used in Program mode. This key allows the user to program a number of continuing strokes in a test program. See section 4.6 “Preset Multiple Cycles Test” for an example of the use of this function.

Jump to TP (<shift> <OPT>) - This key allows the user to jump from one Test Point to another in the Program mode. It is useful when editing an existing program. Press the
<Jump to TP> key then press the number of the desired Test Point.

Speed (<shift> <1>) - The Speed key sets the speed of the upper platform. The default setting is 15.0 in./min. To set the speed, press the <Speed> key, enter the desired speed (within the range of 0.1 to 120 in./min.) and press <ENT>. The new speed will be displayed.

F.L or I.T. (<shift> <2>) - The Free Length or Initial Tension key is used in the Program mode. This key will tell the Tester to determine the Free Length in a Compression test or the Initial Tension in an Extension test. See sections 4.2 “Free Length Test” and 4.12 “Initial Tension Test” for examples on the use of this function.

Peak Force (<shift> <3>) - This key determines the Peak Force during a programmed test.

Delete TP (<shift> <CLR>) - This key deletes the current Test Point in the Program mode.

Insert TP (<shift> <ENT>) - This key is used to enter a Test Point in the Program mode.

Pause (<shift> <0>) - This key enters a pause in the Program mode. When a pause is encountered in a program, the Tester will pause until the two Cycle Start Buttons are pressed.

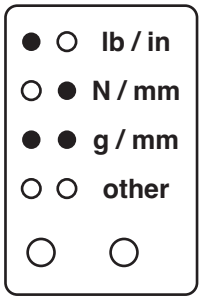
Delay (<shift> < . >) - This key enters a delay (up to 99 min.) in the Program mode. When a delay is encountered, the Tester will halt for the specified time then continue. The delay is entered as a four-digit number: “MMSS”, where MM = minutes and SS = seconds.

Offset (<shift> <PRT>) - This key is used to specify an offset amount to be added to the initialization values for either Length or Force. The default setting is zero. Press the <Offset> key. (The current offset values will be displayed.) The Offset indicator lights turn on, the Length display will flash, and a “-O” will appear in the Test Point display (lower right). Enter the Length Offset then press <ENT>. Next, the Force display will flash. Enter the Force Offset then press <ENT>.

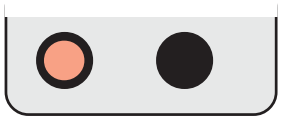
Inc/Abs (<shift> <+/->) The Incremental/Absolute key is used in Program mode. The Absolute setting is the default. In the Absolute setting, the present Test Point will be referenced relative to the initial setting (i.e. zero Force and zero Length). In the Incremental setting the present Test Point will be referenced relative to the previous Test Point. If the first Test Point is an Incremental Test Point, it will be measured relative to the starting Length and Force.

3.3 Data Panel (continued)

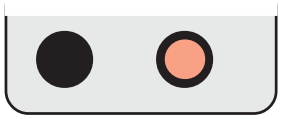
3.3.5 Measurement Unit Indicators - The Measurement Unit Indicators (pictured on the right) confirm the selection of force and length units. Two side-by-side LEDs (located to the left of the LED Display) confirm the selection of force and length units. The default setting is pounds and inches (lbs./in.).



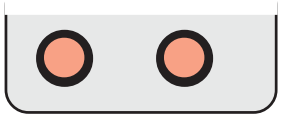
The left LED ON indicates pounds and inches (lbs./in., the default setting).



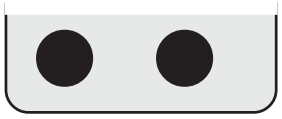
The right LED ON indicates newtons and millimeters (nt/mm).



Both LEDs ON indicate grams and millimeters (g/mm).



Both LEDs OFF indicate one of the "Other" combination of units is designated (lb./mm, nt/in., g/in., kg/in., oz./in. or oz./mm). (See section 5.1.4.)



The Universal Tester allows the operator to easily select lb./in., nt/mm or gm/mm. To select one of these three measurement units, press the <Mode> key so that the Mode light is OFF (Program mode). Then press <Shift> then <7> (Measurement Units). The measurement unit's LEDs will change to reflect the user's selection. To select one of the "Other" combinations of units (lb./mm, nt/in., g/in., kg/in., oz./in. or oz./mm), the user must select "Other" using the <Shift> <7> keystrokes (both LED's OFF). The user must then set up the "Other Measurement Units" parameter to select the desired force/length units. (See section 5.1.4.)

3.4 Initialization

Initialization establishes a reference point for Force and Length measurements. After Start-up, the Universal Tester is in a temporary manual operating mode for initializing the Tester. The initialization procedure must be performed before beginning any tests. The initialization for Compression must be performed before Extension. However, initialization for Extension need not be performed if the Tester is only being used for Compression testing.

During initialization the Tester resets to a 10% force at zero length. For Compression testing, the Tester resets by lowering the upper platform and touching the lower platform with a 10% force applied. For Extension testing, the user must attach two hooks to the platforms and adjust the upper platform until the two hooks are coupled. The Tester then resets by raising the upper platform until the two hooks touch with 10% force applied.

Step-by-step procedures for initialization are detailed in section 4.1 (for Compression) and section 4.11 (for Extension).

3.5 Manual Testing

After Initialization, the operator may conduct a manual test by simply inserting springs or other testable material between the two platforms. Pressing a Jog Button will move the upper platform, which will apply a force and establish a length necessary to conduct the test. The Force and Length are monitored on the LED Display for operator use. Manual testing can be useful for single point tests or special laboratory development tests.

The Force may be tared (or zeroed) in the Test mode. Press the <0> key to zero the Force (up to the load cell capacity).

Manual testing can only be performed in the Test mode. The Universal Tester is in the Test mode immediately after the initialization. To switch back into Test mode after being in Program mode, see section 3.7.3.

3.6 Programmed Testing

The Universal Tester is designed for convenience in performing repeated tests or special one-time tests. Changing to the Program mode permits the user to input programmable information into the Tester. See section 4.0 for specific examples of programming the Universal Tester. Section 3.3.4 “Key Pad” also briefly explains each of the programmable functions.

3.7 Test Mode and Program Mode

After Start-up, the Universal Tester is in a temporary manual operating mode for initializing the Tester. To change the operating mode, simply press the Mode key. The Tester System has two operating modes: Test and Program.

3.7.1 Test Mode is for initialization, calibration, manual operation and starting a programmed test. This mode is signified by the Mode light being ON and by the Force and Length entries on the LED Display being displayed.

3.7.2 Program Mode is for entering specifications to set up a repeatable program. The Program mode is signified by the Mode light being OFF and one or more of the LED Display entries flashing on and off. In programming mode, the display will flash either zeros or dashes. The zeros indicate that a numerical input is required. The dashes indicate that a numerical entry is optional and the user may pass to the next entry.

3.7.3 Switching Between Test Mode and Program Mode - When switching between Test mode and Program mode, it is sometimes necessary to enter a value for the length. This step is necessary immediately after initialization and is also necessary if the previous test specifications have been cleared. The following steps show how to switch between Test and Program modes under these circumstances.

1. Make sure the “Mode” light is ON (indicating the Test mode).
2. Press the <Mode> key. (Enters the Program mode.)
3. Press <Retrieve> then <Ent>. (Clears the test specifications.)
4. Press <1> then <ENT>. (Enters a value of “1” for the Length.)
5. Press <Mode>. (Returns to Test mode.)

3.8 Printing Results

When the printer is connected and turned on (as described in section 2.4), it can provide a record of the testing in four ways:

1. In the Test mode, press the <PRT> key to print the Force and Length measurements that are currently displayed on the LED Display.
2. In the Test mode (after a program has run), the printer will automatically print out the test results.
3. In the Program mode, press the <PRT> key to print a record of the current specifications.
4. In the “E - P -” mode (“EP” number 1234), the user can select how the Tester will print the test information. (See section 5.1.1.)

3.9 Positioning Move

The Positioning Move is a type of Force at Length test where the user enters a specified value for the Length and the value “-99999” for the Force. This will tell the Tester to move the upper platform to the specified length without the precision of a typical Force at Length test. This feature is useful to quickly move the upper platform to a specified length if the precision is not critical. The precision of the Positioning Move is typically +/- 0.001 in. An example of a Positioning Move is included in section 4.10 “Fatigue Test”.

3.10 Free Length Function

The Free Length function determines the length of a spring with no force applied to the spring. This function can be performed in two ways:

3.10.1 Start ABOVE the Free Length - This method is the easier of the two methods because it starts with the upper platform ABOVE the spring's Free Length. An example of this method is described in Section 4.2 "Free Length Test". The following steps will be performed when this method is used. (Please note that in step 1, the upper platform may stop as much as 0.050 inches BELOW the Free Length. This may damage some very short springs. If this is objectionable, use the method described in section 3.10.2).

1. The upper platform goes down at a moderate speed, measuring the force at small intervals. When two consecutive force measurements are unequal (i.e. one zero force and one non-zero force) the upper platform stops.
2. The upper platform then goes up at a slow speed, measuring the force at small intervals. When two consecutive force measurements are the same (i.e. zero) the upper platform stops.
3. The upper platform then goes down again at a very slow speed, stopping when it reads the zero force from step 1.

The length at this point is the Free Length of the spring.

3.10.2 Start BELOW the Free Length - This method is a little more complicated than the previous method. However, the advantage is that there is less overall travel for the upper platform, which will allow for faster testing. Also, this method may be more suitable for some very short springs that may be damaged by the method described in section 3.10.1. To start below the Free Length, slowly adjust the upper platform using the jog switch until it is at least 0.005 in. below the estimated Free Length. Then run the Free Length Test (section 4.2). The following steps will be performed when this method is used:

1. The upper platform goes up at a slow speed, measuring the force at small intervals. When two consecutive force measurements are the same (i.e. zero) the upper platform stops.
2. The upper platform then goes down at a very slow speed, stopping when it reads the first zero force from the previous step.

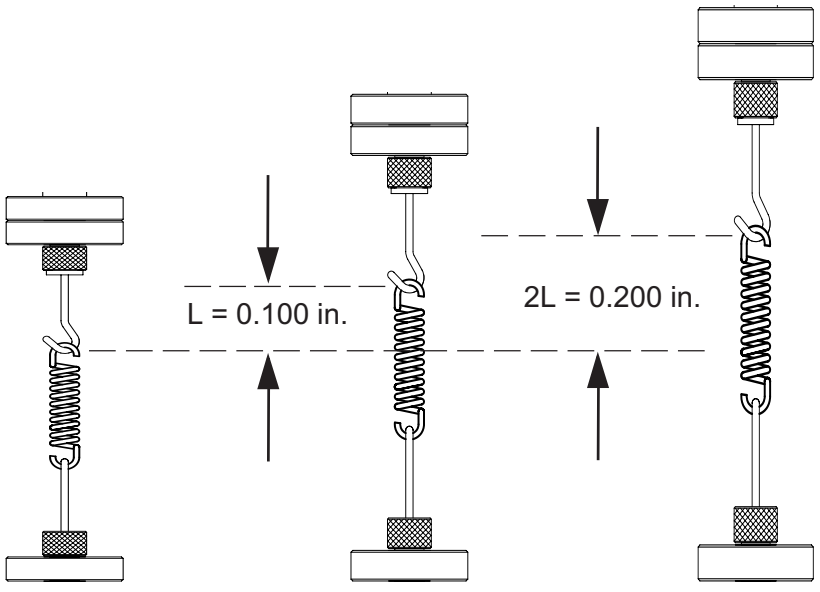
The length at this point is the Free Length of the spring.

3.11 Initial Tension Function

Tension springs are made with a force applied to the spring while it is being wound. The initial tension for a spring is the force required to overcome this intrinsic force present in the spring. The coils of the spring will separate once this force is overcome. The Initial Tension function determines this force. An example of this method is described in Section 4.11 “Initial Tension Test”.

The spring to be tested must first be placed on hooks between the two platforms and there must be no tension (zero force) on the spring. Also, a Length “L” must be entered. (The default value is 0.1 in.) The following steps will be performed when this method is used.

1. The upper platform goes up at a moderate speed, measuring the force at small intervals. When two consecutive force measurements are unequal (i.e. one zero force and one non-zero force) the upper platform stops.
2. The upper platform then goes down at a slow speed, measuring the force at small intervals. When two consecutive force measurements are the same (i.e. zero) the upper platform stops.
3. The upper platform then goes up again at a very slow speed, stopping when it reads the first zero force from step 2.
4. The upper platform goes up and stops at the length “L” (0.1000 in. in this example) and the Force is read.
5. The upper platform goes up and stops at the length “2L” (0.2000 in. in this example) and the Force is read.
6. The initial tension is calculated by extrapolating backwards from the two Forces measured in steps 4 and 5.



Step 3: Spring at zero Force

Step 4: Force is measured at Length “L”.

Step 5: Force is measured at Length “2L”.

3.12 Abort Test Function

The Universal Tester is designed so that the user can elect to abort a programmed test in the middle of a test run. Three reasons a user may want to stop a running programmed test are:

1. If the spring breaks or dislodges from between the platforms.
2. If the spring does not meet the specified Tolerance for Length, Force or Rate.
3. If the user wants to change the features of a test in mid-test.

The user can stop a test in one of two ways: Manual Abort or Programmed Abort.

3.12.1 Manual Abort - The user may abort a programmed test while it is running by pressing a Jog Button. This action will stop the test after the current Test Point. To use this feature push and hold a Jog Button until the test is aborted. The tester will complete the current test point and then abort generating an error, E96.

3.12.2 Programmed Abort - The user may also program the Tester to abort the test if the results do not meet the specified Tolerance for Length, Force or Rate. This feature is set as an Option in the Program mode. When the Programmed Abort function is turned on, the Tester will stop the test whenever a Test Point fails to meet the specified Tolerance. When this occurs, the upper platform will return to the initial position and the Tester will display the data for the out-of-tolerance Test Point. See section 5.2.4 “Programmed Abort Option” for instructions on how to set this function. Also, see section 4.10 “Fatigue Test” for an example that uses the Programmed Abort function.

3.12.3 Abort Test Button - For testers equipped with this button, it allows for the immediate stopping of a test when the upper platform is in motion. When a test is aborted with the Abort Test button, the E98 error code is generated.

3.13 Fatigue Test (Preset Multiple Cycles Test)

The Universal Tester has the capability to conduct a fatigue test. The test uses the Preset Multiple Cycles feature to subject a spring (or other testable material) to a preset force or length for a specific number of cycles. The UT system with the Preset option allows for a maximum of 99 cycles. The UT system with the Fatigue Test option allows for a maximum of 10,000,000 cycles. See section section 4.10 for an example of a fatigue test.

3.14 Adjustable Travel Limit Switch (Option)

The Travel Limit Switch should be positioned slightly above the highest testing point but below the maximum travel length for the part being tested. Please note, the switch does not engage immediately upon the platform touching the switch; the switch must be depressed slightly before it engages.

Positioning The Switch
To adjust the position of the Travel Limit Switch, loosen one or both of the wheel screws enough for the switch to begin moving and slide the switch to the desired position. Tighten the wheel screws finger tight.

Switch Operation
If the switch has been engaged during a test, the tester will generate an Error 98, similar to an Abort Button press. In this case, however, the Adjustable Travel Limit Switch will also lock out the motor. To allow the platform to move again, you must move the platform off the switch. Do this by pressing the release button on the back of the tester computer head and jogging the tester in the appropriate direction to release the switch.

If the switch has been engaged while jogging, no error will be generated, but the motor will be disabled. You must press the release button on the back of the tester computer head in order to jog off the switch.

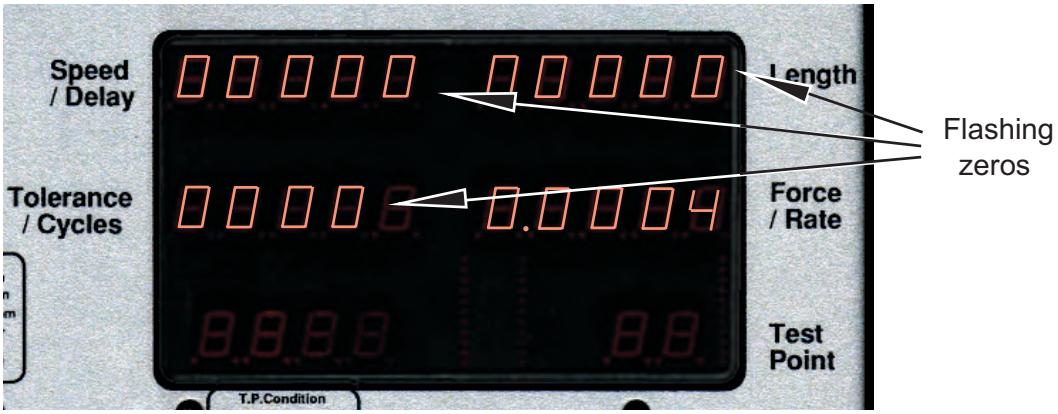
4.0 How to Operate the Universal Tester

This chapter describes several examples of basic operations for the Universal Tester. The step-by-step instructions are designed to give the novice user immediate experience using the Tester. For more detailed descriptions of the features, refer to Section 3.0 “Features and Controls”.

4.1 Power Up and Initialization (Compression Mode)

This exercise describes how to power-up the Tester and how to initialize the unit for Compression testing.

1. Turn the Start/Stop Button clockwise. (The Tester powers-up and goes through a self diagnostic. Afterwards, the display screen shows flashing zeros indicating the Tester must be initialized.)

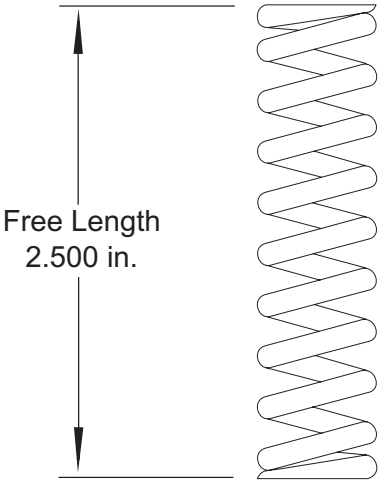


2. Press the Start Test Button. The upper platform lowers and touches the lower platform, then raises to a distance of 2.0000 inches. The Length display reads “2.0000”. The Force display shows a near-zero value for the Force. The Tester is now initialized for Compression testing.

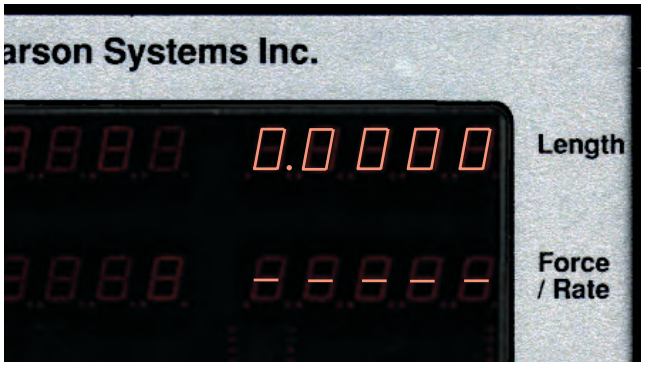
3. Press the Jog Buttons to move the platform up and down. (The Length display accurately displays the distance between the two platforms.)

4. Press <0>. (The Force display reads “0.000”. The Force has been tared (or zeroed).)

4.2 Free Length Test (Length at Zero Force)



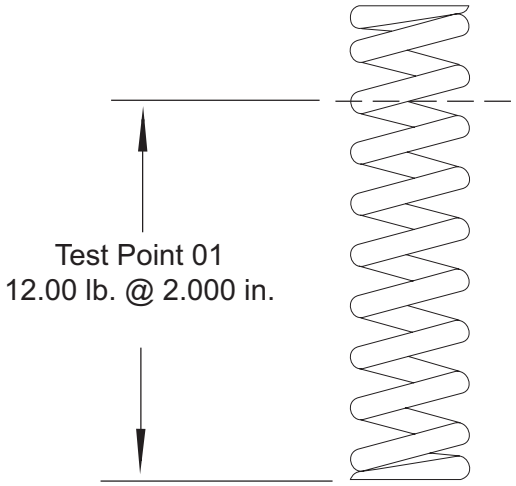
1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).
2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)
3. Press <Shift> then press <2> (<F.L. or I.T.>, the "Free Length or Initial Tension" function). (The "F.L. or I.T." light is ON.)



4. Press the <Mode> key. (The Mode light is ON, indicating the Test mode).
5. Press the appropriate Jog button so that the Length display is greater than 2.5000. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.

6. Press the Start Test Button. (The upper platform lowers until the spring is at its Free Length (length at zero force).) The Length reading on the LED Display will show "2.5000" in. (the Free Length).

4.3 Force @ Length Test



1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).

2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)

3. Press <Shift> then press <8> (<F@L> , the "Force at Length" function). (The "F@L" light is ON and the Length entry flashes 0.0000.)

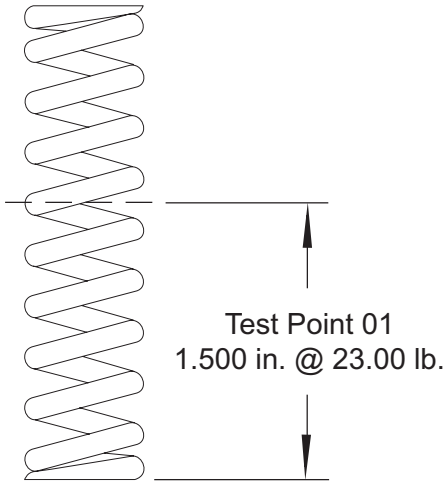
4. Enter 2.0 (length value) then press <ENT>. ("2.0000" appears in the Length entry and the Force entry flashes "- - - - -".)

5. Press the <Mode> key. (The Mode light is ON, indicating the Test mode).

6. Press the appropriate Jog Button so that the Length display is greater than 2.5000. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.

7. Press the Start Test Button. (The upper platform lowers to 2.0000 in. (the specified length). After the test is complete, the platform returns to the starting position. The force obtained at the specified length is displayed. The length display will show "2.0000" and the Force display will show "12.000".)

4.4 Length @ Force Test



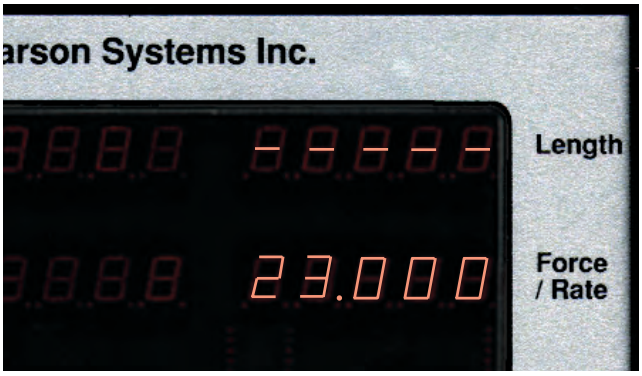
1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).

2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)

3. Press <Shift> then press <9> (<L@F>, the "Length at Force" function". The "L@F" light is ON and the Force entry flashes "0.0000").

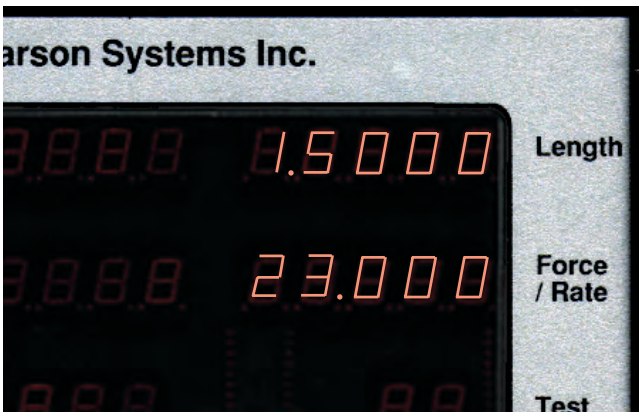
4. Enter 23.0 (force value) then press <ENT>. ("23.000" appears in the Force entry and the Length entry flashes "- - - - -".)

5. Press the <Mode> key. (The Mode light is ON, indicating the Test mode.)



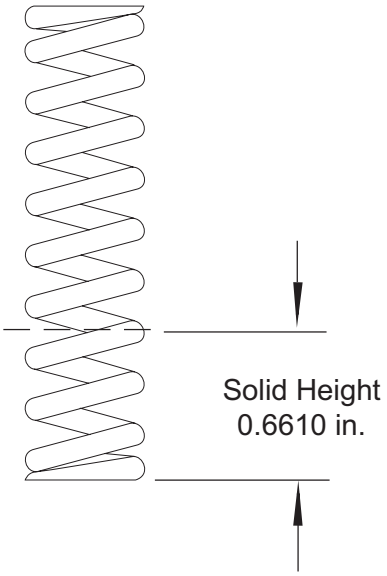
6. Press the appropriate Jog Button so that the Length display is greater than 2.5000. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.

7. Press the Start Test Button. (The upper platform lowers until the spring reaches the specified force (23.000 lbs.). After the test is complete, the platform returns to the starting position. The length at the specified force is displayed. The Length display will show "1.5000" and the Force display will show "23.000".)



4.5 Solid Length Test

Solid Length is the minimum length of a spring and is at the point where the coils touch.



The Solid Length test is similar to the Length @ Force test. To run a Solid Length test, select a Force large enough so that the coils touch but not too large as to cause the coils to misalign. This example will use a Force of 75 lbs.

The Universal Tester comes equipped with overload stops so that mechanical damage to the Load Cell will not occur if too large of a Force is selected.

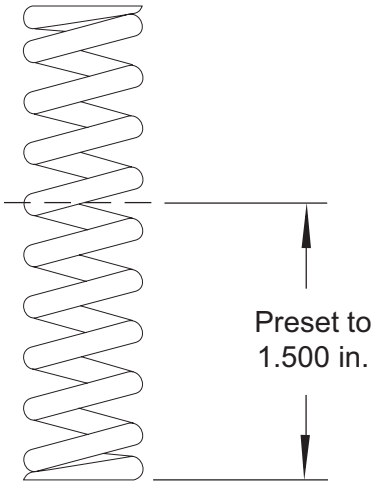
1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).
2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)
3. Press <Shift> then press <9> (<L@F>, the "Length at Force" function". The "L@F" light is ON and the Force entry flashes "0.0000").
4. Enter 75.0 (force value) then press <ENT>. ("75.000" appears in the Force entry and the Length entry flashes "- - - - -".)
5. Press the <Mode> key. (The Mode light is ON, indicating the Test mode.)

6. Press the appropriate Jog Button so that the Length display is greater than 2.5000. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.
7. Press the Start Test Button. (The upper platform lowers until the spring reaches the specified force (75.000 lbs.). At this point, the user should watch the spring and determine if the coils touched, but did not misalign.
8. After the test is complete, the platform returns to the starting position. The length at the specified force is displayed. The Length display will show "0.6610" and the Force display will show "75.000".)
9. If the coils touch but do not misalign, then the user may accept the displayed length as the Solid Height. If the coils do not touch, then the test should be repeated with a larger force. If the coils misalign, then the test should be repeated with a smaller force.

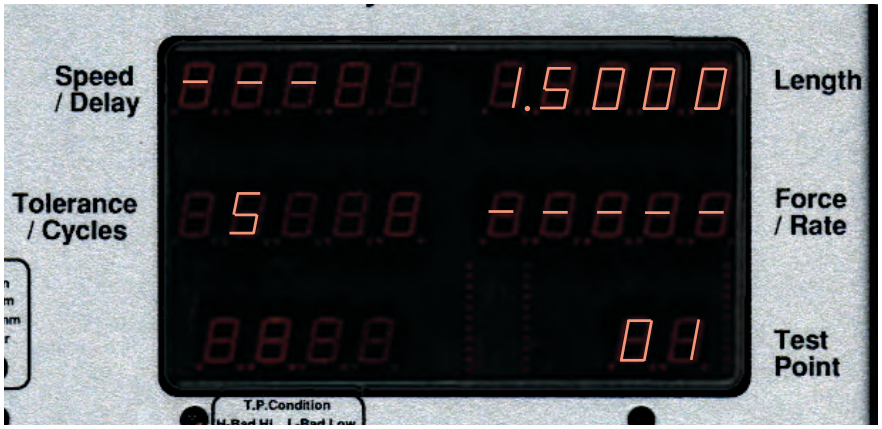
4.6 Preset Multiple Cycles Test

The Preset test is typically used on new springs to condition them before running a Force at Length or a Length at Force test.

The Tester can be programmed to preset to either Force or Length. This example shows how to preset to a Length.

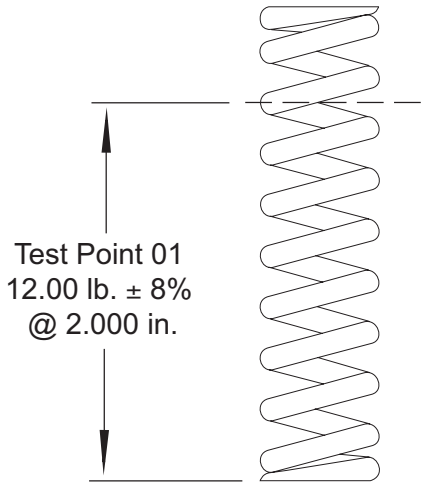


1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).
2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)
3. An “01” appears in the Test Point entry. (Test Point 01 is ready to be entered.)
4. Press <Shift> then <6> (<Preset> function). (The Preset light is ON and the Force entry flashes “- - - - -”).
5. Press <ENT>. The Length entry flashes “- - - - -”. (Skips over the Force entry and allows a Length entry.)
6. Enter 1.5 and press <ENT>. (“1.5000” appears in the Length entry and the Cycles entry flashes “000”.)
7. Enter 5 and press <ENT>. (“5” appears in the Cycles entry.)
8. An “02” appears in the Test Point entry. (Test Point 02 is ready to be entered. The Length entry flashes “0.0000”.)
9. Press the <Mode> key. (The Mode light is ON, indicating the Test mode.)
10. Press the appropriate Jog Button so that the Length display is greater than 2.5000. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.
11. Press the Start Test Button.
12. The Length will show “1.5000” and the upper platform will preset the spring to 1.5000 in. five times.



4.7 Conditional Force @ Length with Tolerance Test

The 8% tolerance means that an acceptable force at 2.000 in. would be between 11.04 lb. and 12.96 lb.



1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).
2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)
3. Press <Shift> then press <8> (<F@L> , the Force at Length function). (The “F@L” light is ON and the Length entry flashes “0.0000”.)
4. Enter 2.0 (length value) then press <ENT>. (“2.0000” appears in the Length entry and the Force entry flashes “- - - - -”.)

5. Enter 12.0 (force value) then press <ENT>. (“12.000” appears in the Force entry and the Tolerance entry flashes “- - -”.)

4.7 Conditional Force @ Length with Tolerance Test (continued)

6. Enter 8.0 (the tolerance in percent). ("8.0" appears in the Tolerance entry. The tolerance value in percent must be between 0.01 and 99.9.)

7. Press <ENT>. (The Length entry flashes "00000" indicating that the Tester accepted the data.)

8. Press the <Mode> key. (The Mode light is ON, indicating the Test mode.)

9. Press the appropriate Jog Button so that the Length display is greater than 2.5000. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.

10. Press the Start Test Button. (The upper platform lowers to 2.0000 in. After the test is complete, the platform returns to the starting position.)

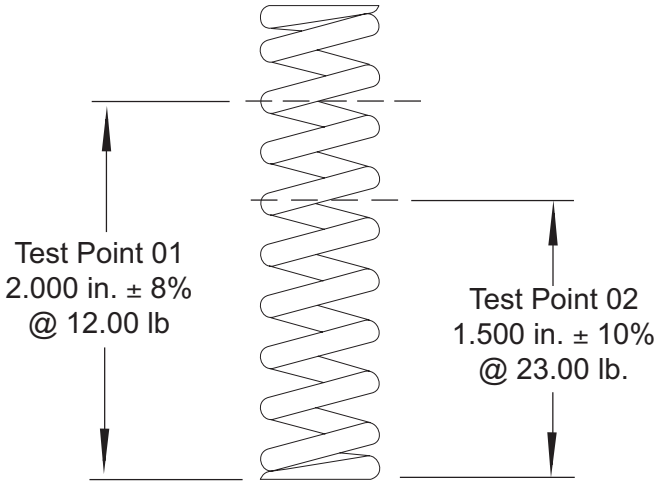
11. The Force obtained at the specified Length is displayed. The Length will show "2.0000" and the Force will show "12.451". The Tolerance is displayed as a percentage of error. The Tolerance will show "3.8". The Good light will be ON and an "S" will appear indicating the Test Spring was within specification.

12. Since the Tolerance was within specification, the "Good" light was ON and an "S" was displayed. (The "S" actually resembles a "5".) If the Tolerance was out of specification, then the "Bad" light would have been ON. An "H" (indicating "high out of spec") or an "L" (indicating "low out of spec") would be displayed.

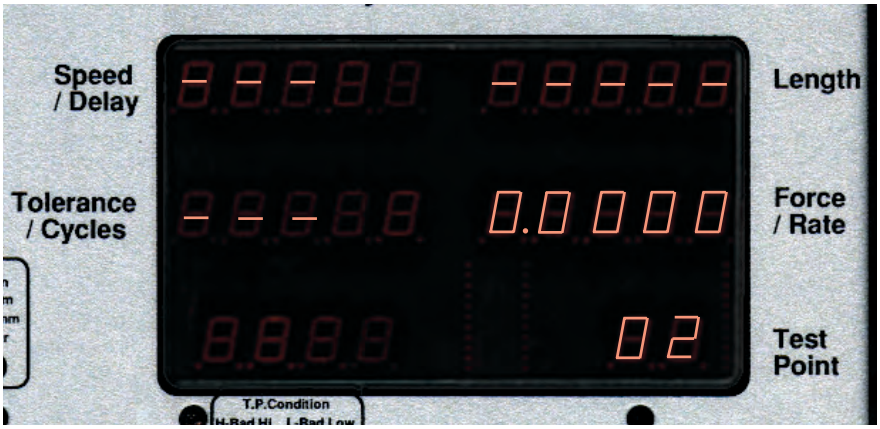
4.8 Two Point Conditional Length @ Force with Tolerance Test

For Test Point 01, the 8% tolerance means that an acceptable length at 12.00 lbs. of force would be between 1.84 in. and 2.16 in.

For Test Point 02, the 10% tolerance means that an acceptable length at 23.00 lbs. of force would be between 1.35 in. and 1.65 in.



1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).
2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)
3. An “01” appears in the Test Point entry, indicating Test Point 01 is ready to be entered.
4. Press <Shift> then press <9> (<L@F> , the Length at Force function). (The “L@F” light is “ON” and the Force entry flashes “0.0000”.)
5. Enter 12.0 (force value) then press <ENT>. (“12.000” appears in the Force entry and the Length entry flashes “- - - - -”.)
6. Enter 2.0 (length entry) and press <ENT>. (“2.0000” appears in the Length entry and the Tolerance entry flashes “- - -”.)
7. Enter 8.0 (the tolerance in percent). (Tolerance must be between 0.01 and 99.9.) (“8.0” appears in the Tolerance entry.)
8. Press <ENT>. (The Length entry flashes “00000”, indicating that the Tester accepted the data.) (An “02” appears in the Test Point entry, indicating Test Point 02 is ready to be entered.)



4.8 Two Point Cond. Length @ Force w/ Tolerance Test (continued)

9. Press <Shift> then press <9> (<L@F>, the Length at Force function). (The “L@F” light is “ON” and the Force entry flashes “0.0000”.)

10. Enter 23.0 (force value) then press <ENT>. (“23.000” appears in the Force entry and the Length entry flashes “- - - - -”.)

11. Enter 1.5 (length value) and press <ENT>. (“1.5000” appears in the Length entry and the Tolerance entry flashes “- - -”.)

12. Enter 10.0 (the tolerance in percent). (Tolerance must be between 0.01 and 99.9.) (“10.0” appears in the Tolerance entry.)

13. Press <ENT>. (The Length entry flashes “00000” indicating that the Tester accepted the data.) (An “03” appears in the Test Point entry, indicating Test Point 03 is ready to be entered.)

14. Press the <Mode> key. (The Mode light is ON, indicating the Test mode.)

15. Press the appropriate Jog Button so that the Length display is greater than 2.5000. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.

16. Press the Start Test Button.

17. The Test Point numbers appear for both Test Points. The Length obtained at the specified Force is displayed for both Test Points. The Tolerance is displayed as a percentage of error.

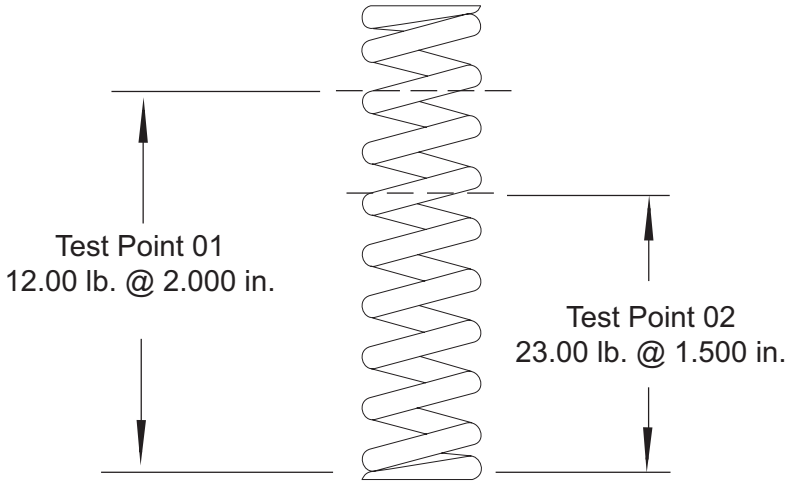
18. For Test Point 01: The Length will show “2.0954”, the Force will show “12.000” and the Tolerance will show “4.8”. The “Good” light will be lit and an “S” will appear indicating the Test Spring was within specification.

19. For Test Point 02: The Length will show “1.4587”, the Force will show “23.000” and the Tolerance will show “2.8”. The “Good” light will be “ON” an “S” will appear indicating the Test Spring was within specification.

20. Since the Tolerance was within specification for BOTH test points, the “Good” light was “ON” and the “S” was displayed. (The “S” actually resembles a “5”.) If the tolerance was out of specification for EITHER test point, then the “Bad” light would be “ON”. An “H” (indicating “high out of spec”) or an “L” (indicating “low out of spec”) would be displayed for each test point that was out of spec.

21. After the test is complete, press <ENT> to scroll through the displays for both test points.

4.9 Two Point Force @ Length with Spring Rate Test



Spring Rate = 22.00 lb./in.

1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).

2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)

3. An “01” appears in the Test Point entry, indicating Test Point 01 is ready to be entered.

4. Press <Shift> then press <8> (<F@L>, the “Force at Length” function). (The “F@L” light is “ON” and the Length entry flashes “0.0000”.)

5. Enter 2.0 (length value) then press <ENT>. (“2.0000” appears in the Length entry and the Force entry flashes “- - - - -”.)

6. Press <ENT> again.

7. An “02” appears in the Test Point entry, indicating Test Point 02 is ready to be entered. (The Length entry flashes “0.0000”.)

8. Enter 1.5 (length value) then press <ENT>. (“1.5000” appears in the Length entry and the Force entry flashes “- - - - -”.)

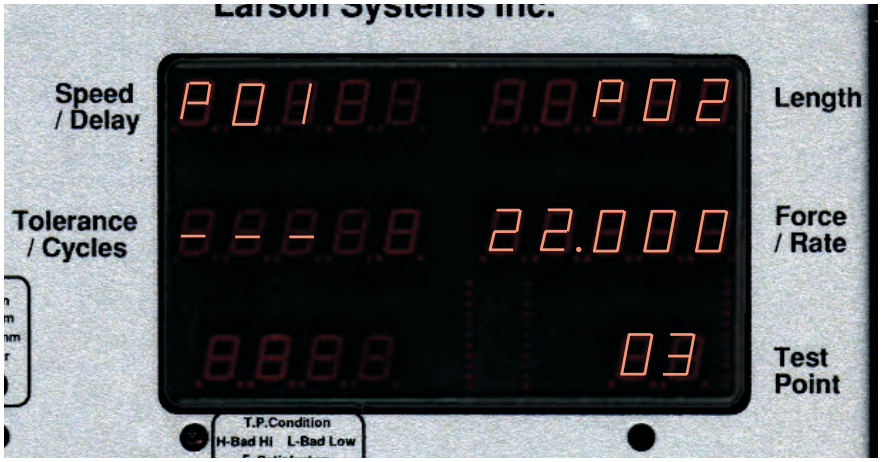
9. Press <ENT> again.

10. An “03” appears in the Test Point entry, indicating Test Point 03 is ready to be entered. (The Length entry flashes “0.0000”.)

11. Press <Shift> then press <5> (<Rate> function). (The “Rate” light is “ON” and “P00” flashes in the upper left corner. The Tester is waiting for the “first point of rate calculation” to be entered.)

4.9 Two Point Force @ Length with Spring Rate Test (continued)

12. Press 1 then press <ENT> (”P01” appears). (“P00” flashes in the upper right corner. The tester is waiting for the “second point of rate calculation” to be entered.)



13. Press 2, then press <ENT>, <ENT>, <ENT>.

14. An “04” appears in the Test Point entry, indicating Test Point 04 is ready to be entered. (The Length entry flashes “0.0000”.)

15. Press the <Mode> key. (The Mode light is ON, indicating the Test mode.)

16. Press the appropriate Jog Button so that the Length display is greater than 2.5000. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.

17. Press the Start Test Button.

18. The Test Point numbers appear for both Test Points. The Force obtained at the specified Length is displayed for both Test Points.

19. For Test Point 01: The Length will show “2.0000” and the Force will show “12.000”.

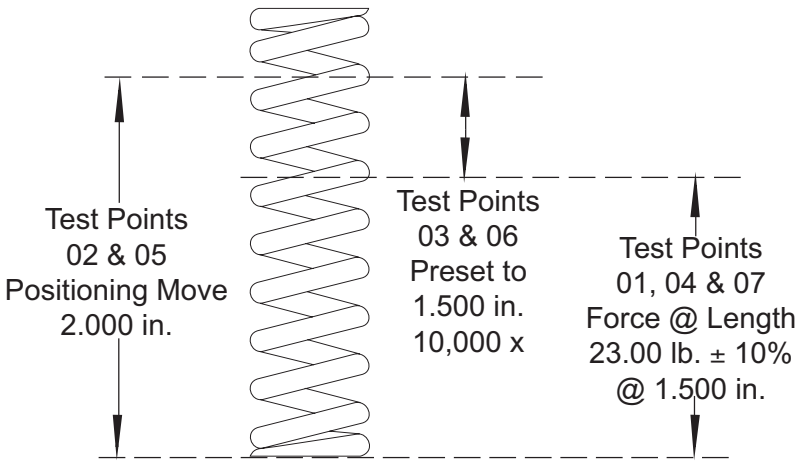
20. For Test Point 02: The Length will show “1.5000” and the Force will show “23.000”.

21. For Test Point 03: The Rate will show “22.00”.

22. After the test is complete, press <ENT> to scroll through the displays of both Test Points (Test Points 01 and 02) and the Spring Rate (Test Point 03).

4.10 Fatigue Test

This example demonstrates how the Universal Tester can conduct a 20,000-cycle fatigue test and also demonstrates the test capability before, during and after the fatigue test.



This example first subjects the spring to a Force @ Length test (23.00 lbs. ±10% at 1.500 in). The 10% Tolerance means that an acceptable Force at 1.500 in. would be between 20.7 lbs. and 25.3 lbs. The upper platform is then positioned using the Positioning Move to reset the upper platform to 2.000 in. The spring is then preset 10,000 times. After the Preset Cycle, the spring is subjected to the Force @ Length test again. The Programmed Abort feature will be turned on, so if the Force at 1.500 in. is not within the specified Tolerance, the Tester will stop the test. The Positioning Move, 10,000-cycle Preset Cycle and Force @ Length test are repeated to complete fatigue test. One final Positioning Move allows the spring to be removed from between the platforms.

1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).

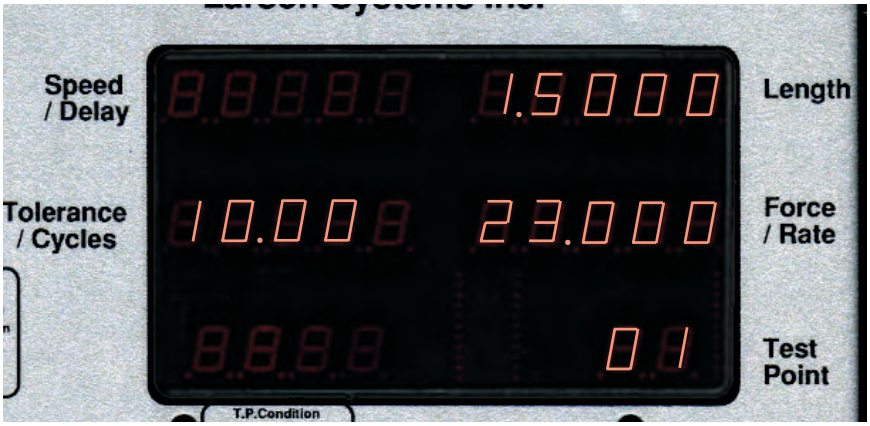
2. Press <Retrieve> then <ENT>. (Clears the previous test specifications. An “01” appears in the Test Point entry. Test Point 01 is ready to be entered.)

3. Press <Shift> then press <8> (<F@L> , the Force at Length function). (The “F@L” light is ON and the Length entry flashes “0.0000”.)

4. Enter 1.5 (length value) then press <ENT>. (“1.5000” appears in the Length entry and the Force entry flashes “- - - - -”.)

5. Enter 23.0 (force value) then press <ENT>. (“23.000” appears in the Force entry and the Tolerance entry flashes “- - -”.)

6. Enter 10.0 (tolerance value) then press <ENT>. (“10.00” appears in the Tolerance entry.)



7. The display changes and an “02” appears in the Test Point entry. Test Point 02 is ready to be entered.

4.10 Fatigue Test (continued)

8. Enter 2.0 (length value) then press <ENT>. (“2.0000” appears in the Length entry and the Force entry flashes “- - - - -”.)

9. Enter -99999 (force value) then press <ENT> TWICE. (This tells the Tester to do a Positioning Move, which will move the upper platform to 2.0000 in.)

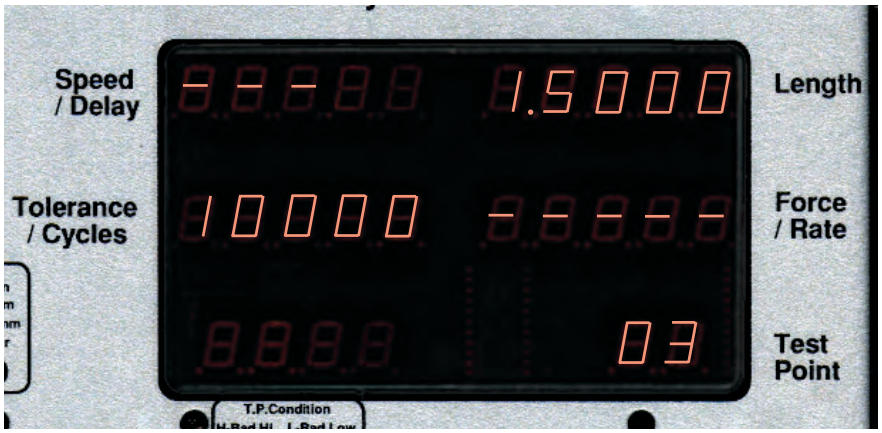
10. The display changes and an “03” appears in the Test Point entry. Test Point 03 is ready to be entered.

11. Press <Shift> then <6> (<Preset> function). (The Preset light is ON and the Force entry flashes “- - - - -”.)

12. Press <ENT>. The Length entry flashes “- - - - -”. (Skips over the Force entry and allows a Length entry.)

13. Enter 1.5 and press <ENT>. (“1.5000” appears in the Length entry and the Cycles entry flashes “000”.)

14. Enter 10000 and press <ENT>. (“10000” appears in the Cycles entry.)



15. The display changes and an “04” appears in the Test Point entry. Test Point 04 is ready to be entered.

16. Repeat steps 3 - 6 for Test Point 04 (Force @ Length). (After repeating steps 3 - 6, an “05” appears in the Test Point entry. Test Point 05 is ready to be entered.)

17. Repeat steps 8 and 9 for Test Point 05 (Positoning Move). (After repeating steps 8 and 9, an “06” appears in the Test Point entry. Test Point 06 is ready to be entered.)

This example continues on the next page ⟶

4.10 Fatigue Test (continued)

18. Repeat steps 11 - 14 for Test Point 06 (Preset Cycle). (After repeating steps 11 -14, an “07” appears in the Test Point entry. Test Point 07 is ready to be entered.)

19. Repeat steps 3 - 6 for Test Point 07 (Force @ Length). (After repeating steps 3 - 6, an “08” appears in the Test Point entry. Test Point 08 is ready to be entered.)

20. For the final Positioning Move (Test Point 08), enter 3.0 (length entry) then press <ENT>. (“3.0000” appears in the Length entry and the Force entry flashes “- - - - -”.)

21. Enter -99999 (force value) then press <ENT> TWICE. (This tells the Tester to do a Positioning Move, which will move the upper platfrom to 3.0000 in.)

22. Press the <OPT> key. (“E - O -“ (“Enter Option”) appears in the LED Display and a zero flashes. The Tester is waiting for an “EO” number.)

23. Enter 4 then press <Ent>. (Enters the Programmed Abort Option. The Data Number (lower right) flashes “000”.)

24. Enter 1, then press <Ent>. (Turns on the Programmed Abort Option.)

25. Press the <OPT> key TWICE. (Exits Options function and returns to Program mode.)

26. Press the <Mode> key. (The Mode light is ON, indicating the Test mode.)

27. Press the appropriate Jog Button so that the Length display is greater than 2.5000. Place the test spring on the lower platform. Press <0> to tare (or zero) the Force.

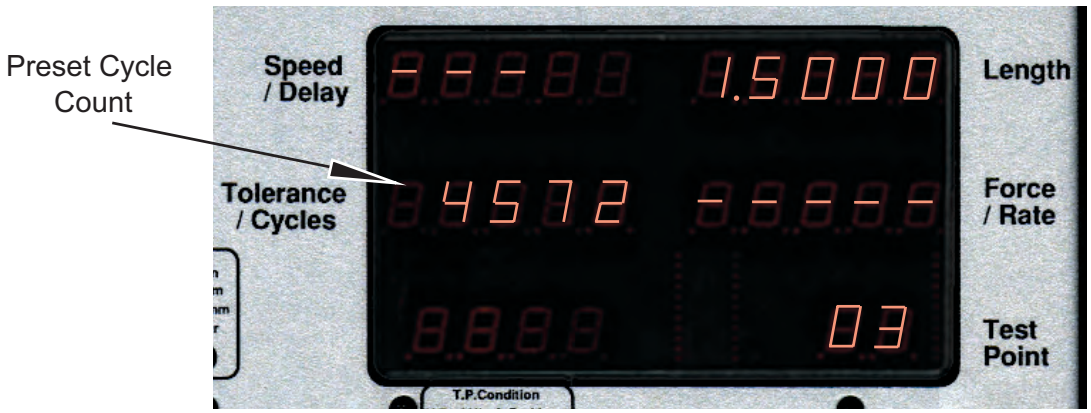
28. Press the Start Test Button.

29. For Test Point 01 (Force @ Length): The upper platform will lower to 1.500 in. The display will BRIEFLY show the Length to be “1.5000”, the Force will show “21.905” and the Tolerance will show “- 4.8”. The “Good” light will be “ON” an “S” will appear indicating the Test Spring was within specification.

4.10 Fatigue Test (continued)

30. For Test Point 02 (Positioning Move): The upper platform will position itself to 2.0000 in. The display will BRIEFLY show the Length to be “2.0000”. (The Force and Tolerance readings have no significance in this step.)

31. For Test Point 03 (Preset Cycle): The Length will show “1.5000” and the upper platform will preset the spring to 1.5 in. 10,000 times. (The Preset Cycles will counted.)



32. The Tester will immediately continue, where...

For Test Point 04 (Force @ Length): Step 29 will be repeated.

For Test Point 05 (Positioning Move): Step 30 will be repeated.

For Test Point 06 (Preset Cycle): Step 31 will be repeated.

For Test Point 07 (Force @ Length): Step 29 will be repeated.

For Test Point 08 (Positioning Move): Step 30 will be repeated (except that the upper platform will position itself to 3.0000 in).

33. Since the Tolerance was in spec for Test Points 01, 04 and 07 (the Force @ Length tests), the “Good” light was “ON” and the “S” was displayed. (The “S” actually resembles a “5”.) If the Tolerance was out of spec for any of the three Test Points (01, 04 or 07), then the “Bad” light would be “ON”. An “H” (indicating “high out of spec”) or an “L” (indicating “low out of spec”) would be displayed. Also, the Tester would stop at the out-of-spec Test Point and display that Test Point’s results. For example, if the Tolerance was in spec for Test Points 01 but not for Test Point 04, then the Tester would stop at Test Point 04 and display the results.

34. After the test is complete, press <ENT> to scroll through the displays for each Test Point.

4.11 Power Up and Initialization (Extension Mode)

This exercise shows the user how to power-up the Tester and how to initialize the unit for Extension testing. In order to initialize for Extension Mode, the Universal Tester must first be initialized for Compression Mode. This exercise describes to the user BOTH the Compression and Extension initialization procedure.

1. Turn the Start/Stop Button clockwise. (The Tester powers-up and goes through a self diagnostic. Afterwards, the display screen shows flashing zeros indicating that the Tester must be initialized.)
2. Press the Start Test Button. (The upper platform lowers and touches the lower platform, then raises to a distance of 2.0000 inches. The Length display reads “2.0000”. The Tester is initialized for Compression mode.)
3. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).
4. Press <1> then <ENT>. (Enters a value for the Length. This is necessary to switch to the extension mode.)
5. Press <SHIFT> then press <4> (<Ext/Cmp> Extension/Compression function). (Switches from Compression to Extension mode. The Extension/Compression light is “ON” indicating “Extension Mode”.)
6. Press the <Mode> key. (Returns to Test mode. The flashing EEEEE indicates that the Tester has not yet been initialized for Extension mode. The Force display will be a near-zero value for the Force.)

Warning: The display must show flashing “EEEEE” (for Extension mode initialization) not flashing “00000” (for Compression mode initialization). Initializing the Tester in Compression mode with the hooks attached to the platforms can damage the Tester and Load Cell!

7. Press the appropriate Jog Button until the platforms are at least 3 inches apart. (This action will separate the platforms to allow enough room for the Extension Hooks to be attached.)

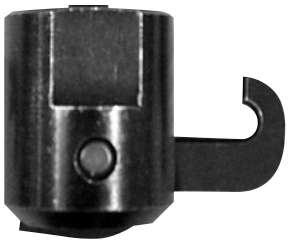
4.11 Power Up and Initialization (Extension Mode) (continued)

8. Attach the Extension Hooks. (Screw the small hook into the lower platform. Screw the large hook into the upper platform by swinging the hook into the "up" position.)
Tighten by hand. Do not over-tighten!

Small Hook
(for lower platform)

Large Hook
"down" position
(for upper platform)

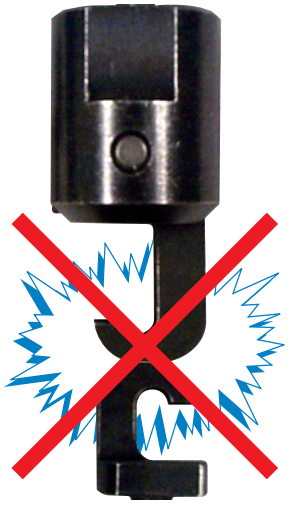
Large Hook
"up" position
(for upper platform)



Large Hook
"reverse-up" position
(for upper platform)

9. With the hook in the "reverse up" position, turn the Jog Switch counterclockwise to lower the upper platform so that the two hooks can be coupled. (The hooks should only be coupled, not touching.)

Coupled Hooks



Use care when lowering the upper platform so that the hooks do not press onto each other with force!

10. Press the Start Test Button. (The upper platform raises until the two hooks touch.)

11. Wait until the Length display reads "0.0000". (The Tester is initialized for Length in the Extension mode.)

12. Carefully press the SLOW DOWN Jog Button so that the hooks can be uncoupled. (The upper platform lowers so that the hooks can be uncoupled.)

13. With the hook in the "reverse up" position, press the SLOW UP Jog Button until the hooks are apart. (The Length display displays the distance between the two hooks.)

14. Press <0>. (The Force shows a near zero value. The Force has been tared.)

4.12 Initial Tension Test (Extension Mode)

Tension springs are made with a force applied to the spring while it is being wound. The initial tension for a spring is the force required to overcome this intrinsic force present in the spring. The coils of the spring will separate once this force is overcome. The Initial Tension function determines this force.

Exercise 4.9 “Power Up and Initialization (Extension Mode)” must be performed before this exercise is attempted. The Tester must first be initialized for Extension Testing.

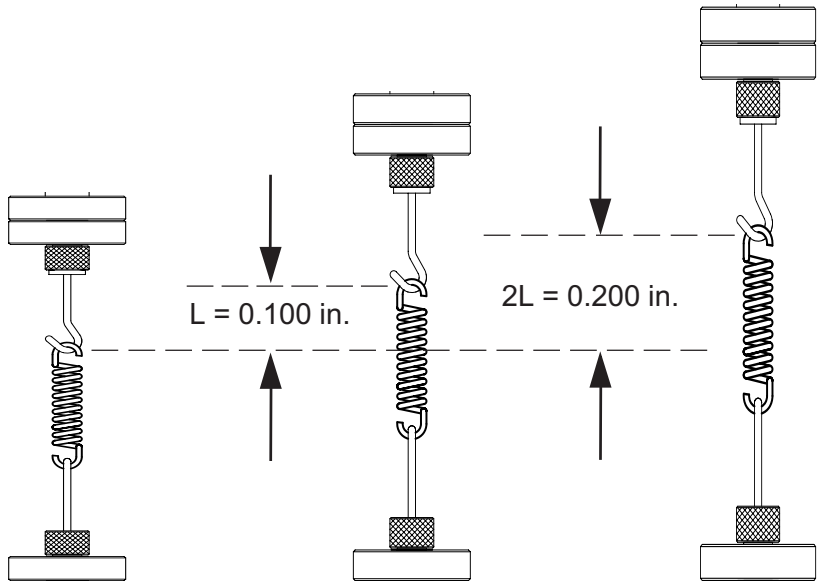
1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).
2. Press <Retrieve> then press <ENT>. (Clears the previous test specifications.)
3. Press <Shift> then press <4> (<Ext/Cmp> Extension/Compression function). (Switches from Compression to Extension mode. The Extension/Compression light is “ON” indicating Extension mode.)
4. Press <Shift> then press <2> (<F.L. or I.T.>, the “Free Length or Initial Tension” function). (The “F.L. or I.T.” light is ON. The Length entry flashes “0.1000”. The Tester automatically sets the default length for the Initial Tension test, which is 0.1000 in.)

5. Press <ENT>. (Sets the Length to the default value of 0.1000 in.) (The user may enter any length “L”. This example uses the default value of “0.1000 in. The length “L” is used to calculate the initial tension.)

6. Press the <Mode> key. (The Mode light is ON, indicating the Test mode.)
7. Press the appropriate Jog Button so that the spring can be attached to the two hooks without any tension applied to the spring.
8. Press <0> to tare (or zero) the Force.
9. Press the Start Test Button.
10. The upper platform adjusts until the spring is at zero Force.
11. The upper platform goes up and stops at the length “L” (0.1000 in. in this example) and the Force is read.

4.12 Initial Tension Test (Extension Mode) (continued)

12. The upper platform goes up and stops at the length “2L” (0.2000 in. in this example) and the Force is read.



Step 10: Spring at zero Force

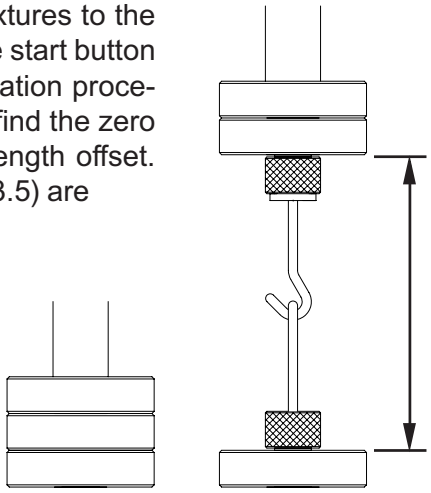
Step 11: Force is measured at Length “L”.

Step 12: Force is measured at Length “2L”.

13. The Initial Tension is calculated by extrapolating backwards from the two Forces measured in steps 11 and 12. The Force display will show “0.1507”, the Initial Tension. The Length display will show “0.1000”, the Length value entered in step 5.

4.13 Extension Initialization

To initialize the tester in extension mode, attach the extension testing fixtures to the upper and lower platform, attach the fixtures to each other, then press the start button when the screen shows flashing E's. The tester will perform an initialization procedure to find the extension initialization offset. This offset will be used to find the zero point for extension testing and is stored as a negative number in the length offset. The reason a negative number is stored is that normal offsets (section 3.3.5) are additive offsets, that is, the number in the offset is added to the length or force reading to adjust for situations like fixtures. The extension initialization offset is used in a negative fashion; the offset is subtracted from the length reading to find the extension zero.



Compression Initialization

Extension Initialization Offset

If, for whatever reason, you cannot perform an extension initialization, you can take precise measurements of your extension fixtures and enter the extension initialization offset manually. You can enter the offset in the normal fashion for offsets (section 3.3.5). Once an offset is programmed for an extension test, the tester will not have to be initialized. The offset will be remembered between extension and compression tests. The offset will also be stored with a test if the Memory Save / Retrieve is used.

4.14 Setting Working Limits

Working Limits are software length limits that you can program so the test will stop if the length limit is reached. Working limits can be set for all tests and, once programmed, are good for all test points in a test. When a test is stored with the Memory Save / Retrieve feature, the Working Limits are saved with the test.

To set the Working Limits, press the SHIFT key then the PRT (Offset) key. This will bring you to the Offset screen. The –O displayed in the Test Point display (the lower right display) tells you that you are in the Offset screen. Press the ENT key twice to scroll through the offsets; you will not be adjusting these.

After you have pressed the ENT key twice, you will be in the Working Limits screen. You will see a –L in the Test Point display. The upper display (Length) is for the upper length limit, and the lower display (Force) is for the lower length limit. Enter a number for the Upper limit and press the ENT key to move to the lower limit, or just press the ENT key to move to the lower limit. Enter a number for the lower limit and press the ENT key or just press the ENT key to exit the Working Limits screen. You may set either an upper limit or a lower limit but you do not have to set both limits.

Error codes because of the Working Limits are generated three places. The first is in program mode. If you try to exit Program mode and you have programmed a Length specification that is outside the Working Limits, you will see either an E87 if you have programmed below the lower Working Limit, or an E88 if you have programmed above the upper Working Limit.

The second place an error can be generated is when you press the start button. If the platform is outside the Working Limits before a test is started, you will receive either an E87 or an E88 if the platform is below the lower or above the upper Working Limit, respectively. You must then move the platform with the Jog buttons to be within the Working Limits.

Finally, you will receive an error if the platform moves past a working limit while a test is being performed. If a Working Limit is passed, an E87 or E88 will be generated and the platform will stop for going past a lower or upper limit, respectively and the error will be recorded on a printout if you have a printer attached.

4.14 Setting Working Limits (Continued)

When the platform stops for a Working Limit Error during testing, it will not stop at exactly the specified Working Limit. The platform will over travel by approximately 0.05 inches (0.125 mm). Be aware of this fact when programming your specific limits.

5.0 Setting Global Parameters, Options and Memory Functions

5.1 How To Set Global Parameters ("E - P -" Mode)

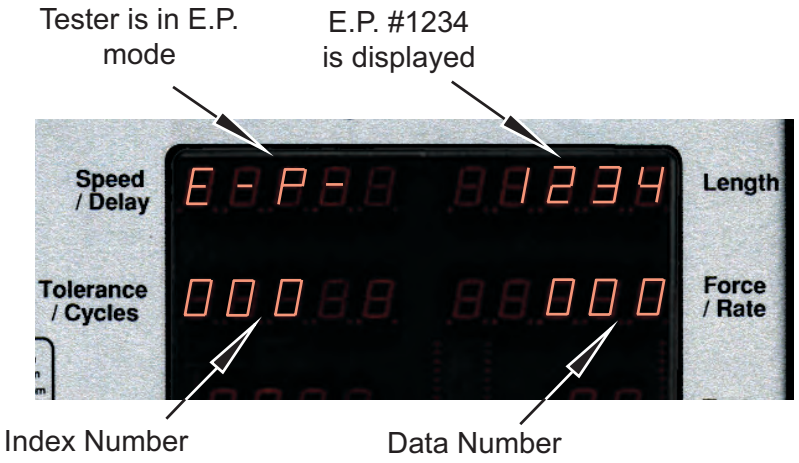
Global Parameters are entered in the "E - P -" mode where "E - P -" means "Enter Parameter". Global Parameters are set in the Test mode and affect all tests. The tables on the facing page list the "EP", Index and Data Numbers and their associated functions for the various Global Parameters. The following steps explain how to enter the Global Parameters.

1. Press the <Mode> key so that the "Mode" light is ON (indicating the Test mode).

2. Press the < +/- > key. ("E - P -" ("Enter Parameter") appears in the LED Display and a zero flashes. The Tester is waiting for an "EP" number.)

3. Enter the four-digit "EP" number. For example, the "EP" number for the print format is "1234". To enter this number press "1234" then press < Ent >.

4. Two more numbers illuminate on the LED Display. The Index Number is on the left. The Data Number is on the right.



5. Press the <Ent> key to scroll through the Index Numbers. To continue the above example, pressing the <Ent> key will scroll through Index Numbers 0, 1 and 2.

6. The Data Number is the flashing number. This number represents the data associated with the displayed Index Number.

7. To continue the above example, press the <Ent> key until the Index Number shows "000". The Data Number is flashing "000".

8. Press <0> then press <Ent>. The Tester accepted the entry "0" for Index Number "000". (This entry tells the Tester to print the specifications.) The Tester then automatically scrolls to Index Number "001".

9. Press the < +/- > key. To continue the above example, this entry tells the Tester that the user is finished modifying the Print parameters. The Index and Data numbers disappear and a flashing "0" appears. The user may now enter another "EP" number.

10. To enter a new "EP" number and modify its data, go to step 3.

11. Press < +/- > to exit the Global Parameters function. This will return the Tester to the Test mode.

5.1 How To Set Global Parameters ("E - P -" Mode) (continued)

5.1.1 Printing - Tells the tester how to print the test information.

"EP" No.	Index Number	Data Number
1234	0000 Test Specs	0 = print the specification 1 = do not print the specification
	001 Test Results	0 = print headings on all pages 1 = do not print the results 2 - 99 = print headings on first page only 100 - 120 = time delay after 10 data points 100 = 0.0 seconds 101 = 0.1 seconds > > > incr. 0.1 second for each Data Number < < < 120 = 2.0 seconds
	002 Test Summary	0 = print headings on all pages 1 = do not print the summary 2 - 99 = print headings on first page only

5.1.2 Shunt Calibration - Turns the internal shunt calibration on and off.

"EP" No.	Index Number	Data Number
4085	0000	0 = shunt resistor off, shunt calibration disabled 1 = shunt resistor off, press <Shift><9> to enable A/D calib. 2 = turn on shunt resister to check calibration

5.1.3 Powerup Measurement Units - Sets the default units when the tester is turned on.

"EP" No.	Index Number	Data Number
4430	0000	0 = lb./in. (default) 1 = nt./mm 2 = g/mm(< 56 lb load cells) Kg/mm (>56 lb load cells) 3 = Other Measurement Units

5.1.4 Other Measurement Units - Selects one of the following measurement units.

"EP" No.	Index Number	Data Number
4431	0000	0 = lb./mm (default) 1 = nt./in. 2 = g/in. or kg/in. 3 = oz./in. 4 = oz./mm

5.1.5 Memory Save / Retrieve - Selects whether the Options (Section 5.2) are saved to memory.

"EP" No.	Index Number	Data Number
8389	0000	0 = save to memory (default) 1 = do not save to memory

5.1.6 Skip Beep After Bad Test - Tells the tester whether or not to beep after a bad test.

"EP" No.	Index Number	Data Number
9896	0000	0 = "beep" after each bad test (default) 1 = do not "beep" after each bad test

5.2 How To Set Options (“E - O -” Mode)

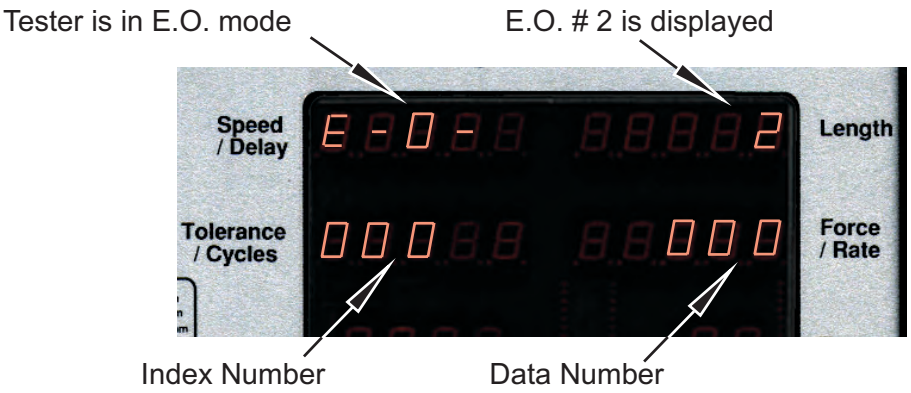
Options are set for individual test specifications (as opposed to the Global Parameters which are set for all tests). Options are entered in the “E - O -” mode where “E - O -” means “Enter Option”. Options include the upper platform start position and test point display. Options also include the Sorting options. (See Section 6.0 “Sorter” for more information on the sorting features of the Universal Tester.) Unlike Global Parameters, Options are set to default values when the Tester is turned off or when the specifications are cleared. (The specifications are cleared using the keystrokes: <Retrieve> then <ENT>.) The following steps explain how to set the Options.

1. Press the < Mode > key so that the “Mode” light is OFF (indicating the Program mode).

2. Press the < OPT > key. (“E - O -“ (“Enter Option”) appears in the LED Display and a zero flashes. The Tester is waiting for an “EO” number.)

3. Enter the “EO” number. For example, “EO” number for the Automatic Platform Return Option is “2”. To enter this number, press < 2 > < Ent >.

4. Two more numbers illuminate on the LED Display. The Index Number is on the left. The Data Number is on the right.



5. The Data Number is the flashing number. This number represents the data associated with the displayed Index Number.

6. To continue the above example, press < 0 >, then press < Ent >. The Tester accepted the entry “0” for Index Number “000”. (This tells the Tester to return the platform to the start position after a programmed test is complete.)

7. Press the <OPT> key. To continue the above example, this will tell the Tester that the user is finished modifying the Automatic Platform Return Option. The Index and Data numbers disappear, and a flashing “0” appears. At this point, the user may now enter another “EO” number.

8. To enter a new “EO” number and modify its data, go to step 3.

9. Press <OPT> to exit the Options function. This action will return the Tester to the Program mode.

The tables on the next two pages list the “EO”, Index and Data Numbers and their associated functions for the various Options.

5.2 How To Set Options ("E - O -" Mode) (continued)

5.2.1 After Test Display Option - Specifies the display at the end of a test.

"EO" No.	Index Number	Data Number
1	0000	0 = last Test Point is displayed (default) * 1 - 99 = Test Point 1 - 99 is displayed ** 100 = the initial display is displayed
* If the Sorting Option is enabled, then the inital display (sort, test count) is displayed ** If the number > the number of Test Points, then the last Test Point is displayed		

5.2.2 Automatic Platform Return Option - After each test, the upper platform returns to its initial starting position by default. This option will override the default. Three reasons a user may want to override the default are:

1. Performing a height calibration.
2. Moving quickly to a certain force or length while in Test mode.
3. Testing a spring that cannot sustain a rapid fast return speed.

"EO" No.	Index Number	Data Number
2	0000	0 = platform returns to start position (default) 1 = platform remains at the last test point

5.2.3 Return Platform on Overload Option - Returns the platform to the initial start position when an overload is encountered during a test.

"EO" No.	Index Number	Data Number
3	0000	0 = do not return platform on an overload (default) 1 = return platform on an overload

5.2.4 Programmed Abort Option - Set the tester to abort a programmed test if the results of a test point do not meet the specified tolerance for length, force or rate.

"EO" No.	Index Number	Data Number
4	0000	0 = do not abort test if result is out of spec (default) 1 = abort test if result is out of spec

5.2.5 Min / Max Force on a Peak Force Test Option - Set the tester to test for the minimum or maximum force on a peak force test.

"EO" No.	Index Number	Data Number
5	0000	0 = test for maximum force on a Peak Force test (default) 1 = test for minimum force on a Peak Force test

5.2 How To Set Options ("E - O -" Mode) (continued)

The following tables list the "EO", Index and Data Numbers and their associated functions for the various Sorting Options. See Section 6.0 "Sorter" for more information on the sorting features of the Universal Tester.

5.2.6 4 or 5 Way Sorting Option - This option efficiently lets consecutive absolute F@L or L@F tests that have the same length for F@L or force for L@F use the same test result. This allows tests to have different tolerances and utilizes 4 or 5 way sorting.

When the test point is finished, the last programmed test (of the identical set) will be displayed. The first and middle point(s) results can be reviewed by using the enter button when the entire test is finished.

"EO" No.	Index Number	Data Number
6	000	0 = normal operation 1 = consectutive absolute F@L or L@F tests that have the same length for F@L or force for L@F use the same test result

5.2.7 Sorter Flap Option - The default flap is actuated if no flap conditions defined in the sort table are true.

"EO" No.	Index Number	Data Number
101	000	0 = do not actuate any flap (normal) 1 = actuate flap 1 2 = actuate flap 2 4 = actuate flap 4 8 = actuate flap 8 1-255 = acuate combination of flaps

5.2.8 Sorter Plunger / End of Test Option - Turns on or off the plunger / end of test signal. The user may want to disable the plunger / end of test signal during manual sorting.

"EO" No.	Index Number	Data Number
102	000	0 = actuate plunger as normal (default) (send end of test signal) 1 = disable plunger / end of test signal

5.2.9 Sorter Delay Option - This option specifies a delay between the time the plunger is deactivated and the time the flaps are deactivated. This is the time it takes the spring to fall through the sorter. The operator cannot perform another test until after this delay. The delay can be set to any value between 0 and 25 seconds (in increments of 0.1 s). The delay in seconds = data number entry x 0.1.

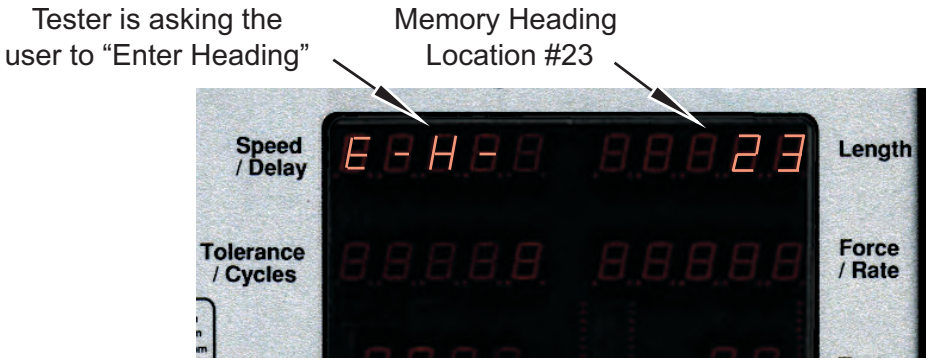
"EO" No.	Index Number	Data Number
103	000	0 = 1 second delay (default) 1 - 250 = delay enabled (0.1 - 25.0 seconds) 253 = no delay, flaps are disabled (for manual sorting) 234 = no delay, flaps are actuated until start buttons are pressed 255 = no delay, flaps are actuated until the next test changes the flap position

5.3 How to Use Memory Save/Retrieve (“E - H -” Mode)

The Memory Save and Memory Retrieve functions allow the user to save and retrieve the Options (section 5.2) and the Sort Table (section 6.1). There are 300 Memory Save/Retrieve heading locations. The Universal Tester can also store up to 1320 test points, which can be divided up into the 300 memory settings. This arrangement provides, on average, between 4 and 5 Test Points per memory heading. The Memory Save/ Retreive functions are performed in the Program mode. The procedure is detailed below:

5.3.1 How to Save the Current Settings

1. Press the <Mode> key so that the “Mode” light is “OFF” (indicating the Program mode).
2. Press the <Save> key. (“E - H -“ appears in the LED Display and a zero appears in the upper right corner. The “E - H -” stands for “Enter Heading” which is short for “Enter Memory Heading Location”.)
3. Enter a number between 1 and 299. (The number is displayed in the upper right corner of the LED Display.)



4. Press <ENT> to complete the procedure. (The Tester returns to the Program mode.)

5.3.2 How to Retrieve Previously Saved Settings

1. Press the <Mode> key so that the “Mode” light is “OFF” (indicating Program mode).
2. Press the <Retrieve> key.
3. Enter the Memory Heading Location (a number between 1 and 299).
4. Press the <ENT> key to complete the procedure. (Tester returns to Program mode.)

5.3.3 How to Clear the Current Settings - This procedure was performed several times in section 4.0 “How to Use your Tester”. To clear the current settings, simply retreive Memory Heading Location “0” which sets all settings to the defaults.

1. Press the <Mode> key so that the “Mode” light is “OFF” (indicating Program mode).
2. Press the <Retrieve> key.
3. Memory Heading Location #0 is displayed.
4. Press the <ENT> key to complete the procedure. (Tester returns to Program mode.)

6.0 Sorter

The Sorter is used to sort springs based on the results of a spring test performed on the Universal Tester. The Sorter is pictured on the facing page with the Universal Tester. After the test, a sorter plunger pushes the spring down a chute into the Sorter. The flaps on the Sorter are designed to deflect the spring into the appropriate bin. If no flaps are actuated, the spring will fall straight down to the center bin. A 3-way sorter with the three bins is pictured to the right. The Sorter software can be used to sort parts mechanically (with the sorter connected) or manually (without a sorter connected). A manual sort is accomplished by setting up the Universal Tester to display the flap number after the spring is tested. The flap number would correspond to a bin number. The operator would then throw the spring into the appropriate bin.

It is highly recommended that the user become familiar with the basic operations of the Tester prior to setting up sorting specifications. Please review section 4.0 “How to Operate Your Tester” and section 5.0 “Setting Global Parameters, Options and Memory Functions”.

The procedure to set up a Sort test is summarized in table 6.0 below. The steps include setting up the Sort Table, setting the three Sorter options, entering the Sorting Test Specifications, saving the Sort Information and testing the springs.

Table 6.0 - Procedure to Set Up a Sort Test

Step	Mode	Procedure Step
1	EO #100	Enter the Sort table (sections 6.1 - 6.2).
2	EO #101	Set the Flap option (section 6.3).
3	EO #102	Set the Sorter Plunger Enable/Disable option (section 6.3).
4	EO #103	Set the Sorter Delay option (section 6.3).
5	Program Mode	Enter the Sorting Test Specificaitons (section 6.4).
6	"E - H -" Mode	Save the Sort Information to a memory heading (section 6.5).
7	Test Mode	Test the springs (section 6.6).

6.1 The Sort Table

The Sort Table is a summary of the desired sorting steps and is similar to a written computer program. A Sort Table must be drawn up for each sort procedure. Table 6.1 is an example of a Sort Table. Each of the new terms used in the Sort Table are defined below:

6.1.1 Index Number - The index number defines each line on the Sort Table (similar to a line in a written computer program). Up to 50 lines can be programmed (Index Numbers 000 - 049). Each line on the Sort Table consists of a pair of numbers, which are either the Test Point/Condition pair or the Terminate/Flap pair.

Note: The “Test Point” is always paired with the “Condition” and the “Terminate” is always paired with the “Flap”.

6.1.2 Test Point - The test point is the condition that is being evaluated. For example, a test point might involve measuring the force of a spring when compressed to 2 inches. The default value is “0”. Up to 1320 test points may be entered into the Tester.

6.1.3 Condition - Once a test point has been evaluated, there are six conditions that can describe the results of the Test Point. The default setting is “00”.

(00) = Default

(01) = Satisfactory

(02) = Bad Low

(03) = Bad High

(04) = Not Satisfactory (Bad Low or Bad High)

(05) = Not Low (Satisfactory or Bad High)

(06) = Not High (Satisfactory or Bad Low)

6.1.4 Terminate - The value for the terminate is always “00” and signals the last line in a “flap condition”. (See section 6.1.6 for the definition of “flap condition”.)

6.1.5 Flap - The flap refers to the particular flap on the Sorter. The default flap is “00”, which means no flaps are actuated.

6.1.6 Flap Condition - A flap condition includes one or more Test Point/Condition pairs plus one Terminate/Flap pair. After the Universal Tester tests a spring, the Sort Table is checked. If all the test point conditions compare the same as those for a given flap condition, then the specified flap is actuated. When a flap condition is found to be true, no other flap conditions will be checked. If all of the flap conditions are false, then the default flap “00” is actuated. This means that no flaps will be actuated.

6.1 The Sort Table (continued)

Table 6.1 - Example of a Sort Table

"EO" Number	Flap Condition	Index Number	Test Point [Terminate]	Condition [Flap]	Comments: (TP = Test Point)
100	*Flap Condition A*	000 001	01 [00]	003 [001]	if TP 01 is Bad High (03) then actuate Flap 01
	Flap Condition B	002 003 004	01 01 [00]	004 002 [002]	if TP 01 is Not Satisfactory (04) and, if TP 01 is Bad Low (02) then actuate Flap 02
	Flap Condition C	005 006	01 [00]	001 [000]	if TP 01 is satisfactory (01) then actuate Flap 00
		007	00	- -	End of Sort Table.

The example in table 6.1 will be discussed step by step. This example is for a spring that is tested at one test point (TP 01). After the Universal Tester tests the spring, the computer compares the results in order to determine how the Sorter flaps should be actuated, which will allow the spring to be placed into the proper bin. Please note that the Sort Table example is written with more commands than is needed. This was done to adequately explain the concept of the Sort Table.

Flap Condition A (Index Nunbers 000 and 001) is a test for flap 01. If the result of the test is a “Bad High” (03) result, then “Flap Condition A” is true and then flap 01 will be actuated. If the test is false, then “Flap Condition A” is false and the computer moves on to “Flap Condition B”.

Flap Condition B (Index Numbers 002, 003 and 004) is a test for flap 02. Flap Condition B is also an example of a compound test (i.e. more than one test point/condition pair). This means that Test Point 01 must be both “Not Satisfactory” (04) AND “Bad Low” (02) for “Flap Condition B” to be true. If both of these tests are true, then “Flap Condition B” is true and then flap 02 will be actuated. If EITHER test is false, then “Flap Condition B” is false and the computer moves on to “Flap Condition C”.

Flap Condition C (Index Numbers 005 and 006) is a test for flap 00 (the default flap). If the result of the test is “Satisfactory” (01), then “Flap Condition C” is true and then flap 00 (i.e. no flaps) will be actuated. If the test is false, then “Flap Condition C” is false and the computer moves on to the next step in the Sort Table.

The next step (Index Number 007) is the end of the Sort Table. Since this is the end of the Sort Table, the default flap 00 is activated. This means no flaps will be actuated.

If one of the Flap Conditions are found to be true, then subsequent Flap Conditions will not be checked. For example, if Flap Condition A is found to be true, then flap 01 will be activated, Flap Conditions B and C will not be checked, and the sorting test will end.

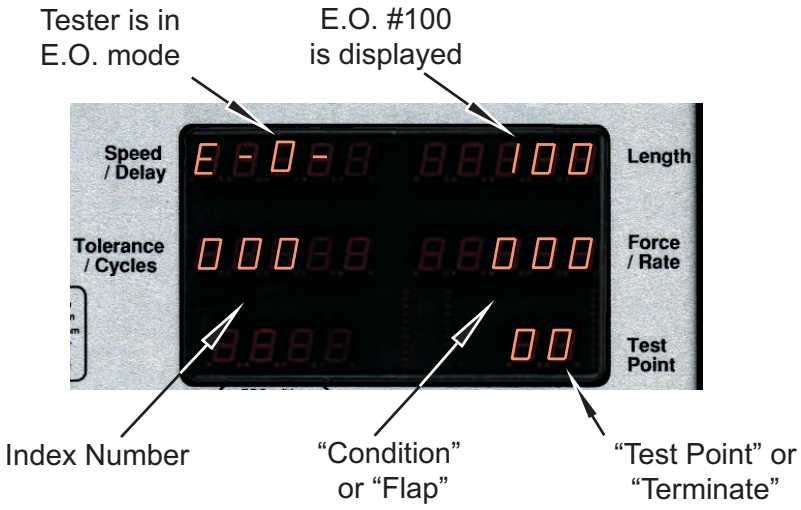
6.2 How to Enter a Sort Table

The Sort Table is entered in the “E - O -” mode where “E - O -” stands for “Enter Option”. The “EO” number for the Sort Table is “100”. The following steps explain how to enter the the Sort Table.

1. Press <Mode> so that the “Mode” light is “OFF” (indicating the Program mode).

2. Press the <OPT> key. (“E - O -“ appears in the LED Display and a zero flashes. The Tester is waiting for an “EO” number.)

3. Enter the “EO” number for the Sort Table, which is “100”. To enter this number, press “100” then <ENT>.



4. Three more numbers illuminate on the LED Display. The Index Number is on the left. Press the <ENT> key to scroll through the Index Numbers.

5. The number in the bottom right corner flashes. This number has a dual function and can be either the “Test Point” or the “Terminate”. To enter a value, simply enter the number, then press <ENT>. For example, pressing <1> then <ENT> enters the number “01”.

6. Next, the number above the ”Test Point”/“Terminate” flashes. This number also has a dual function and can be either the “Condition” or the “Flap”. To enter a value, simply enter the number, then press <ENT>. For example, pressing <1> then <ENT> enters the number “001”.

8. The display then automatically scrolls to Index Number “001”. To enter the data for the next Index Number, go to step 5.

9. When all of the information for the Data Table has been entered, press the <OPT> key TWICE. This will return the Tester to the Program mode.

6.3 How to Set the Sort Options

Once the Sort Table has been entered into the tester and saved, setting the Sort Specifications is the last step before starting a sort test. This procedure is explained in section 5.2 “How to Set Options” but a specific example will be used here. In this example, the following options are to be set:

- Do not actuate any flaps if no flap conditions are found to be true (EO 101).
- Enable the plunger (EO 102).
- Set a 0.5 second delay between the time the plunger is deactivated and the time the flaps are deactivated (EO 103).

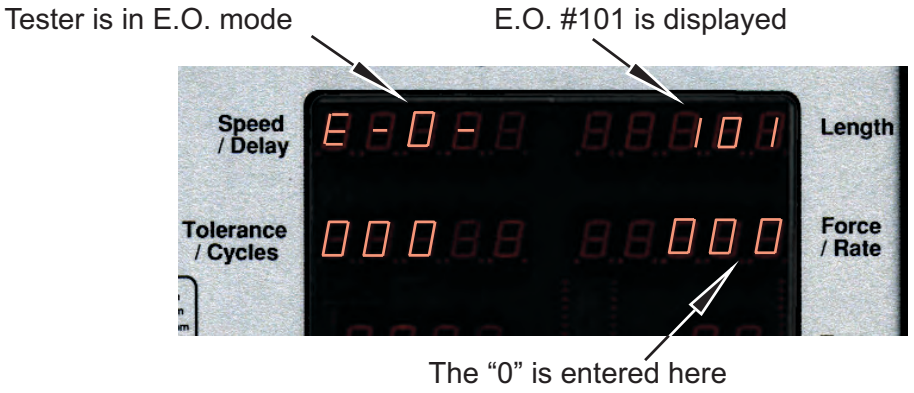
The procedure to set these Sort Options is detailed below:

1. Press <Mode> so that the “Mode” light is OFF (indicating the Program mode).

2. Press <OPT>. (“E - O -“ appears in the LED Display.)

3. Press “101” then <ENT> to set the Sorter Default Flap Option (EO101).

4. Press “0” then <ENT>. (Tells the Tester to actuate no flaps if no flap conditions are found to be true.)



5. Press <OPT>. (The Tester accepts that entry. An “E-O-“ appears in the LED Display.)

6. Press “102” then <ENT> to set the Sorter Plunger Enable/Disable Option (EO 102).

7. Press “0” then <ENT>. (Tells the Tester to actuate the plunger as normal).

8. Press <OPT>. (The Tester accepts that entry. An “E-O-“ appears in the LED Display.)

9. Press “103” then <ENT> to set the Sorter Delay Option (EO 103).

10. Press “5” then <ENT>. (Tells the Tester to set a 0.5 second delay between the time the plunger is deactivated and the time the flaps are deactivated.)

11. Press <OPT>. (The Tester accepts that entry. An “E-O-“ appears in the LED Display.)

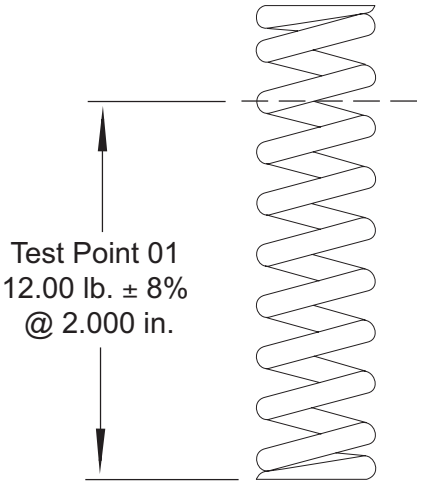
12. Press <OPT> again to exit the Options function. This will return the Tester to the Program mode.

6.4 How to Enter the Sorting Test Specifications

The Sorting Test Specifications are the values of Length, Force, Tolerance and/or Rate that are entered into the Universal Tester's memory. The Tester compares this information with the springs that are tested to decide how the test springs should be sorted. The example that will be used in this this case will be the "Conditional Force at Length Test with Tolerance Test". (This test is also detailed in section 4.7.) The specifics of this test and the procedure for entering the data into the Tester are listed below.

Conditional Force @ Length with Tolerance Test

The 8% tolerance means that an acceptable force at 2.000 in. would be between 11.04 lb. and 12.96 lb.



1. Press the <Mode> key so that the Mode light is OFF (indicating the Program mode).
2. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)
3. Press <Shift> then press <8> (<F@L>, the Force at Length function). (The "F@L" light is ON and the Length entry flashes "0.0000".)
4. Enter 2.0 (length value) then press <ENT>. ("2.0000" appears in the Length entry and the Force entry flashes "- - - - -".)

6.4 How to Enter the Sorting Test Specifications (continued)

5. Enter 12.0 (force value) then press <ENT>. (“12.000” appears in the Force entry and the Tolerance entry flashes “- - -”.)

6. Enter 8.0 (the tolerance value). (“8.0” appears in the Tolerance entry. The tolerance value in percent must be between 0.01 and 99.9.)

7. Press <ENT>. (The Length entry flashes “00000” indicating that the Tester accepted the data.)

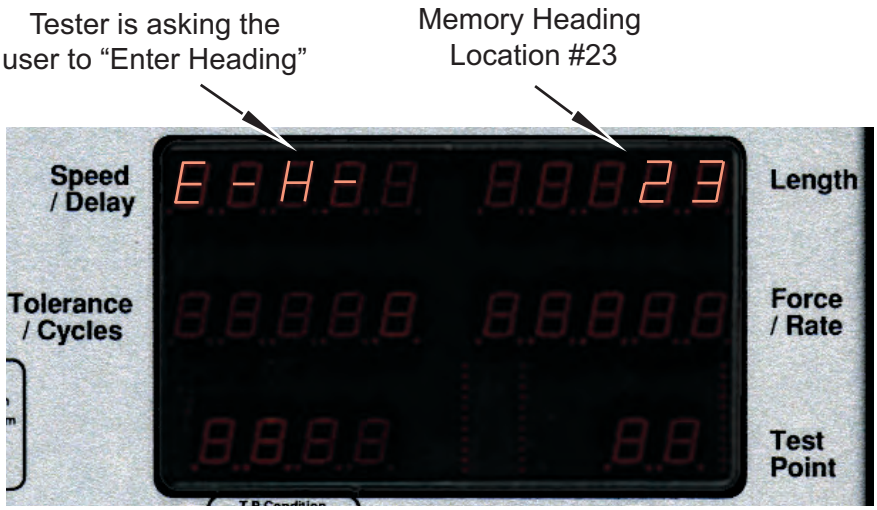
8. Press the <Mode> key. (The Mode light is ON, indicating Test mode.)

6.5 How to Save and Retrieve the Sort Information

The Sort Table and the Sort Options are saved together with the Sorting Test Specifications. This Sorting Information is saved to and retrieved from the Tester's memory in the same way as described in section 5.4 "How to Use Memory Save/Retrieve". To review, the functions are performed in the Program mode and the procedure is detailed below. (Note: Saving sort information will reduce the memory available to other Save/ Retreive specifications.)

6.5.1 How to Save the Current Sort Information

1. Press the <Mode> key so that the "Mode" light is "OFF" (indicating the Program mode).
2. Press the <Save> key. ("E - H -" appears in the LED Display and a zero appears in the upper right corner. The "E - H -" stands for "Enter Heading" which is short for "Memory Heading Location".
3. Enter a number between 1 and 299. (The number is displayed in the upper right corner of the LED Display.)



4. Press <ENT> to complete the procedure. (The Tester returns to the Program mode.)

6.5.2 How to Retreive a Previously Saved Sort Information

1. Press the <Mode> key so that the "Mode" light is "OFF" (indicating the Program mode).
2. Press the <Retrieve> key.
3. Enter the Memory Heading Location (a number between 1 and 299).
4. Press <ENT> to complete the procedure. (The Tester returns to the Program mode.)

6.6 How to Start the Sort Test

After the Sort Table, Sort Options and Sort Test Specifications have been entered and after the Sorting Information has been saved, the Tester is ready to sort springs. If sorting springs using the mechanical sorter, refer to the Automated Testing System Operator's Manual (part no. 60-1000-035) for detailed information on using the automated Sorter with the Universal Tester. If sorting springs manually, use the procedure below. This procedure continues with the same example cited throughout this section.

1. Place the Test Spring on the lower platform. Press <0> to tare (or zero) the Force.

2. Press the Start Test Button. (The upper platform lowers to 2.0000 in. After the test is complete, the platform returns to the starting position.)

3. The force obtained at the specified length is BRIEFLY displayed. The Length will show "2.0000" and the Force will show "12.451". The tolerance is displayed as a percentage of error. The Tolerance will show "3.8". The Good light will be ON and an "S" will appear, indicating the Test Spring was within specification.

This screen will be BRIEFLY displayed.

4. Since the tolerance was within specification, the "Good" light was ON and an "S" was displayed. (The "S" actually resembles a "5".) If the tolerance was out of specification, then the "Bad" light would be ON. An "H" (indicating "high out of spec") or an "L" (indicating "low out of spec") would be displayed.

5. After the test is complete, the LED display will change and display the Flap Number (which is the same as the Bin Number). The user should then deposit the spring into the designated bin. The spring order (1, 2, 3, etc.) will also be displayed.

Bin Number (Flap Number)

Spring Order (first spring in the series to be tested)

6. Press the <ENT> key to display the Length, Force and Tolerance information.

7. Repeat the procedure for each spring that needs to be sorted.

6.7 How to Clear the Sort Table but Save the Sort Options

To clear the Sort Table but save the current Sort Options and Sort Specifications, set the first Sort Table entry to “0”, save the Sort Information to an unused Memory Heading Location, then retrieve from that same location.

6.8 If Errors Occur While Sorting

If an error occurs during a test, the test point in error will be displayed at the end of the test and sorting will not be performed. At this point, the platform will stop. If sorting springs using the mechanical Sorter, the upper platform may be in the way of the plunger. Refer to the Automated Testing System Operator’s Manual (part no. 60-1000-035) for information on how to troubleshoot the Sorter when errors occur.

6.9 How to Disable Sorting

To disable Sorting, set the Index entry to 000 and the Test Point entry to “00”.

7.0 Maintenance, Calibration and Diagnostics

7.1 Maintenance

7.1.1 Dust Cover - To ensure trouble-free operation of the electronic components, avoid exposing the Universal Tester to moisture, heat, corrosive elements or excessive dust. Consider purchasing a dust cover available from LSI (Part no. 059-001-008 for the UT 11 series. Part no. 059-001-009 for the UT 24 Series.)

7.1.2 Fan Filter – A fan inside the data panel circulates air to keep the electronics from overheating. The fan filter (located on top of the data panel) prevents dust from entering the data panel. At a minimum, the fan filter should be replaced quarterly. If the Universal Tester is in a high-particulate atmosphere, the fan filter should be replaced more often. Replace with LSI part no. 011-4000-09.

7.1.3 Surge Protector - Since microcomputer components are sensitive to power line high voltage transients and IF noise, consider installing a power conditioning noise filter and voltage spike protector (such as Radio Shack IF Filter/Spike Protector, Part No. 61-2785) for trouble free operation.

7.1.4 Fuse - When necessary, replace the power fuse located in the back of the Tester behind the cover plate in the lower left corner. The replacement fuse must be a 5 amp Slo-Blo fuse (Littelfuse 313005 or equal). If the fuse burns out frequently, notify LSI.

7.2 Calibration

Keeping the Universal Tester calibrated is very important! LSI recommends that every Tester be calibrated on a regular basis. The frequency of calibration is largely dependent on use and operating conditions. Heavy usage and adverse operating conditions require more frequent calibration. Initial calibration should occur after three to six months of use. If no calibration adjustments are required, the period can be extended. A one-year calibration interval is typical.

7.2.1 On-Site Calibration Service – LSI technicians can provide calibration and a general checkup of your Universal Tester at your facility. An NIST traceable certificate of calibration is included with this service.

7.2.2 Factory Calibration Service - The Universal Tester can be returned to our factory for calibration and a general check-up. It is then returned to your facility with a certificate of calibration.

7.2.3 User Calibration - LSI provides the necessary accessories and procedures for users to do their own calibrations. The accessories include a User's Calibration Manual, Certified Gage Blocks, Certified Weights and a Load Cell Extension Cable. For information on calibrating the Tester, see "Universal Tester Calibration Manual" (Part No. 60-1000-014).

7.3 Verifying Calibration

The purpose of this section is to provide three different methods for the user to verify the calibration of the Universal Tester. The ISO 9000 standards often require verification of the calibration of the Universal Tester. If the Tester is out of calibration, refer to the UT Calibration Manual or call LSI for assistance.

The three methods to verify the calibration are:

- Shunt Calibration - The fastest of the three methods, but only verifies the force.
- Using a Calibrated Spring - Also fast and is a more comprehensive test than the Shunt Calibration test.
- Using Calibrated Gauge Blocks and Weights - The most time consuming test but is the most comprehensive test.

Note: These procedures are to be used only for daily calibration checks. They are not intended to replace the necessary periodic calibrations.

7.3.1 Shunt Calibration - The Universal Tester has a standard force (approximately 85% of the Load Cell's full scale) hard-wired into the computer's circuitry. When the Shunt Calibration is turned on, the LED will display the Shunt Calibration force. If this displayed force does not closely match the original Shunt Calibration force (recorded on the calibration certificate), then the Tester is out of calibration. This simple test makes verifying the calibration very easy. The procedure for the Shunt Calibration method is detailed below:

1. Press "0" to tare (or zero) the Force.

2. Press the <Mode> key so that the "Mode" light is ON (indicating the Test mode).

3. Press the < +/- > key. (Enters the "E - P -" mode.)

4. Enter "4085" then press <ENT>. (4085 is the four-digit "EP" number for the shunt calibration.)

5. Enter "2" then press <ENT>. (Turns on the Shunt Calibration.)

6. Press < +/- > TWICE to exit the "E - P -" mode. (Returns the Tester to test mode.)

7. The LED Display shows the Shunt Calibration force in the Force display.

8. Compare the displayed value to the Shunt Calibration force recorded on the calibration certificate.

9. If the displayed value is outside the specified range recorded on the calibration certificate, then the Tester must be recalibrated. Refer to the UT Calibration Manual.

10. Press the < +/- > key. (Enters the "E - P -" mode.)

11. Enter "4085" then press <ENT>.

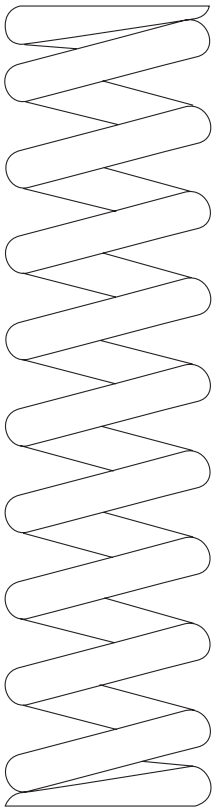
12. Enter "0" then press <ENt>. (Turns off the Shunt Calibration.)

13. Press < +/- > TWICE to exit the "E - P -" mode. (Returns the Tester to test mode.

7.3 Verifying Calibration (continued)

7.3.2 Using a Calibrated Spring - The chart below will be used as an example to explain the method using a calibrated spring. The information listed is the length and force data for a calibrated spring with a range of 0 - 10 lbs. The tolerance listed at the bottom of the chart refers to the length measurements. This particular spring would be useful to check the calibration of the 11-lb. Load Cell. To verify the calibration using this method, the user would first select a calibrated spring that would cover the range of the Load Cell in use. The user would then enter the data corresponding to that particular calibrated spring into the Universal Tester. Finally, the user would run the test described below. If all ten Test Points pass the calibration check within the spring's tolerance limit, then the Tester is still calibrated. However, if ANY of the test points fall outside the tolerance limit, then the Tester must be recalibrated. The procedure is detailed below.

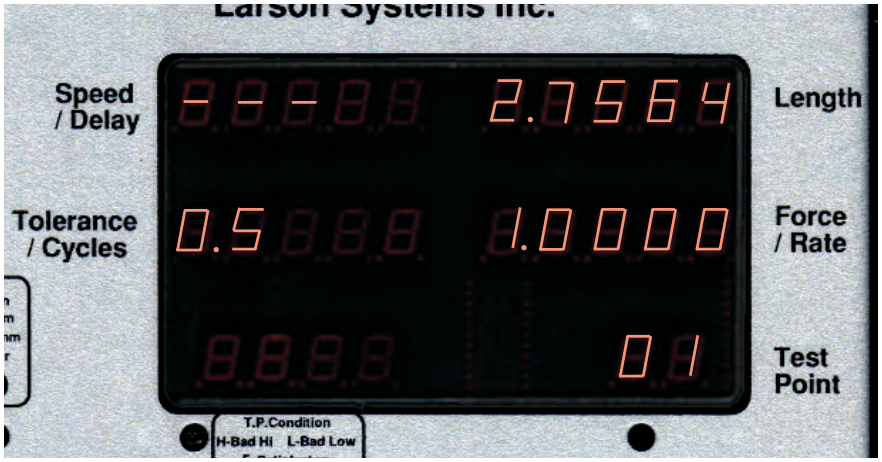
Calibrated Spring		
Test Point	**Force (lb.)**	**Length (in.)**
01	1.000	2.7564
02	2.000	2.5624
03	3.000	2.3673
04	4.000	2.1701
05	5.000	1.9716
06	6.000	1.7728
07	7.000	1.5871
08	8.000	1.4088
09	9.000	1.2365
10	10.000	1.0650
	tolerance:	< 0.5%



1. Press "0" to tare (or zero) the Force.
2. Press the <Mode> key so that the "Mode" light is "OFF" (indicating the Program mode).
3. Press <Retrieve> then <ENT>. (Clears the previous test specifications.)
4. An "01" appears in the Test Point entry. (Test Point 01 is ready to be entered.)
5. Press <Shift> then <9> (<L@F>, the "Length at Force" function). (The "L@F" light is "ON" and the Force entry flashes "0.0000".)
6. Enter 1.0 (force value) and press <ENT>. ("1.000" appears in the Force entry and the Length entry flashes "- - - - -".)
7. Enter 2.7564 (length value) then press <ENT>. ("2.7564" appears in the Force entry and the Tolerance entry flashes "- - - - -".)
8. Enter 0.5 (tolerance value). ("0.5" appears in the Tolerance entry.)

7.3 Verifying Calibration (continued)

7.3.2 Using a Calibrated Spring (continued)



9. Press <Ent>. (The display changes to Test Point 02.)

10. Repeat steps 5 - 9 while entering the values for Force and Length for each Test Point as listed in the table on the previous page. Enter 0.5 for the tolerance value for each Test Point. Be sure to press <Shift> then <9> (<L@F> function) before entering each Force and Length Test Point.

11. Save these programming steps in a memory heading for use at a later date. Press <Save>, then <5>, then <ENT>. The Tester saves the programming steps into Memory Heading #005.

12. Press <Mode> to return to the Test mode. ("Mode" light is ON, indicating Test mode.)

13. To retrieve the programming steps, press <Mode> ("Mode" light is OFF, indicating Program mode), then <Retrieve>, then <5>, then <Mode> ("Mode" light is ON, indicating Test mode).

14. Place the Calibrated Spring on the lower platform and press <0> to zero the Force.

15. Press the Start Test Button.

16. The Tester will check the Length at the specified Force for all ten Test Points. For each test point, the Force, Length and Tolerance is displayed.

17. After the test is complete, press <ENT> to scroll through the displays for all ten Test Points.

18. If the Universal Tester is still properly calibrated, the "Good" (green) light will be ON.

19. If the Tester was out of calibration, then the "Bad" light would be ON. Also, an "H" (indicating "high out of spec") or an "L" (indicating "low out of spec") would be displayed for each individual test point that was out of spec. If this is the case, then the Tester must be recalibrated.

7.3 Verifying Calibration (continued)

7.3.3 Using Gauge Blocks and Weights - This method is the most thorough of the three verification methods and is carried out in three steps: Deflection, Length and Force. Each step is detailed below. The Spring Tester Calibration Package (available from LSI) is required when using this method. The Calibration Table on the next page is used to record the results of the calibration check. All references to line A, line B, etc. refer to the Calibration Table. The table may be photocopied for subsequent calibration checks.

The Deflection, Length and Force error values must be within the specification limits listed in section 1.6. If any of the error values are outside the specified range, then the Tester must be recalibrated. Refer to the UT Calibration Manual.

Deflection

1. Press the <Mode> key so that the Mode light is ON (indicating the Test mode).
2. Press <0> to tare (or zero) the Force.
3. Place a 0.1-inch gauge block on the lower platform.
4. Lower the upper platform until the Force reading is about 5% of the Load Cell's full scale. Enter the Length reading in line A.
5. Lower the upper platform until the Force reading is about 95% of the Load Cell's full scale. Enter the Length reading in line B.
6. Calculate the error by subtracting line B from line A and enter this value in line C.
7. Continue on to the next section: "Length".

Length

1. Leave the 0.1-inch gauge block on the lower platform.
2. Lower the upper platform until the Force reading is about 45% to 55% of the Load Cell's full scale (or 100 lbs., whichever is lighter). Enter the gauge block length (0.1 in.) and the Length reading in line D.
3. Calculate the error by subtracting the Length reading from the gauge block length (0.1 in.) and enter the error in line D.
4. Raise the upper platform and place the appropriate combination of gauge blocks on the lower platform to obtain a length of 25% of the Tester's maximum length.
5. Lower the upper platform until the Force reading is about 45% of the Load Cell's full scale. Enter the length of the gauge blocks and the Length reading in line E.
6. Calculate the error by subtracting the Length reading from the length of the gauge blocks and enter the error in line E.
7. Repeat steps 4 - 6 for the following lengths and enter the results in the following lines of the Calibration Table:

   Enter the results for 50% of the maximum length in line F

   Enter the results for 75% of the maximum length in line G

   Enter the results for the (maximum length - 0.5 in.) in line H
8. Raise the upper platform and remove the gauge blocks from the lower platform.
9. Continue on to the next section: "Force".

7.3 Verifying Calibration (continued)

7.3.3 Using Gauge Blocks and Weights (continued)

Force

1. Leave the upper platform raised. With no weight on the lower platform, record the Force reading in line J.
2. Calculate the error by subtracting the Force reading from the actual weight. Enter the error in line J.
3. Place the appropriate combination of weights on the lower platform to obtain a force of 45% of the Load Cell's maximum force. Record the Force reading in line K.
4. Calculate the error by subtracting the Force reading from the actual weight. Enter the error in line K.
5. Place the appropriate combination of weights on the lower platform to obtain a force of 90% of the Load Cell's maximum force. Record the Force reading in line L.
6. Calculate the error by subtracting the Force reading from the actual weight. Enter the error in line L.
7. Remove the weights from the lower platform. (The procedure to verify the calibration using gauge blocks and weights is complete.)

CALIBRATION TABLE

UT number _____	**UT Load Cell number** _____ .
UT model # _____	**UT Load Cell max. weight** _____ **lbs.**

Deflection

Line	Test Length	Gauge Block Length	Length reading	Error
A	5% of full scale	0.1 in.	_____in.	
B	95% of full scale	0.1 in.	_____in.	
C				_____in.

Length

Line	Test Length	Gauge Block Length	Length reading	Error
D	0.1000 in	0.1 in.	_____in.	_____in.
E	25% max length	_____in.	_____in.	_____in.
F	50% max length	_____in.	_____in.	_____in.
G	75% max length	_____in.	_____in.	_____in.
H	Max length - 0.5 in	_____in.	_____in.	_____in.

Force

Line	Test weight	Actual weight	Force reading	Error
J	Zero	0.0 lbs.	_____lbs.	_____lbs.
K	45% of full scale	_____lbs.	_____lbs.	_____lbs.
L	90% of full scale	_____lbs.	_____lbs.	_____lbs.

Completed by _____ **Date** _____

7.4 Diagnostics

The purpose of this section is to provide a few, simple diagnostic instructions. These instructions will help the user assess any problems with the Universal Tester before calling the LSI service technician. The following instructions cover the User Interface Start-Up Sequence and allow the user to diagnose any problems with the use of the Display Panel (Key Pad, Jog Switch, Display Screen and LED Lights). These diagnostic steps can be performed without the use of any tools and without disassembling the Universal Tester. Any additional problems should be diagnosed and fixed by the LSI service technician.

User Interface Start-Up Sequence - The following is a list of what to expect during a normal start-up process. Turn the red Start/Stop Button clockwise to activate the power. The fan should spin up to speed, indicating that power is present. The following is what the user will see.

1. **Lights** - All lights, including the LED's, will flash then go blank.

2. **Master Board / Memory Check** - A number will be displayed in the lower right corner of the display. This number will increment with each internal test performed. The numbers will count from 0 through 10. (Software versions 30.2 and older will count to 7. Software versions 30.3 through 30.5 will count to 9. Software versions 30.6 to present will count to 10.)

3. **Display Check** - Next, all lights will light up for about half a second then the display will shut down from left to right showing all lighting elements, followed by the lights on the front panel which will flash momentarily to show that they are operational.

4. **Software Version Check** - Next, the internal software version will be displayed in the upper right corner of the display for 3 seconds. (This feature is only on software versions 30.6 to present.)

5. **Pre-Initialize Check** - The display should now have 3 sections flashing just zeros, and the force display should read a force close to zero (assuming no force is currently being applied).

6. **Force Check** - Press down on the lower platform and release to confirm that the force displayed increases then returns to zero. Next, lift on the lower platform and release to confirm that the force displayed decreases then returns to zero. Record the value of the no load force, then zero the force by pressing "0".

   Note: A high force reading after power-up may indicate an over stressed Load Cell.

7. **Jog & Length Check** - Using the Jog Buttons, move the upper platform up and down several inches, several times.

8. **Drive Check / Start Buttons** - Initialize the Tester by pressing the Start Test Button. Notice that the Tester's upper platform should come down and contact the lower platform for several seconds, then the upper platform should rapidly rise to 2.0000 inches. The Lenth display should show "2.0000" inches.

7.4 Diagnostics (continued)

9. **Length Check -** Carefully jog the upper platform down **SLOWLY** until it makes contact with the lower platform, apply a slight load and notice the display length should read zero ±.001 inches. (Gauge blocks may also be used to verify the length.)

10. **Keypad Check** - Press the <Mode> key then press <7>, <8>, <9>, <Shift>. Next, press <CLR> then press <4>, <5>, <6>, <OPT>. Next press <CLR> then press <1>, <2>, <3>, <PRT>. Next press <CLR> then press <1>, <ENT>. Finally, press <Retrieve>, <0>, <ENT> then press <Save>, <0>, <ENT>. These steps verifiy the operation of the keypad.

11. **Return to Test Mode -** Press <1>, <ENT>, <Mode> to return to the Test mode.

If each of the previous steps were performed without incident, the Universal Tester system is functioning according to LSI's specifications. If there were failures during the previous steps, the Tester must be repaired by an LSI service technician. Please note the specific failures when calling LSI as this will help the service technician quickly diagnose the problem. LSI may be contacted between 8:00 AM and 4:30 PM Central Time at 763-780-2131.

8.0 System Error Codes

UT Error Code Definitions			
Error Number	Error Type	Description	Components Affected
1	Testing	Force requested, with offset, is greater than allowed force	-
2	Power-up	Timer failed at start-up	Master Board
3	Jog	Attempting to jog in direction of force when past full scale.	-
4	Testing / Jog	Force overload	-
5	Testing / Jog	Attempting to jog beyond max length	-
6	Printing	Error in calculating spring rate	-
7	Power-up	Memory chip checksum error	Analog / Memory Board
8	Manual Mode	Tare is past full scale	-
9	Initializing	Attempting to initialize with more than 10% applied force	-
10	Power-up	A/D processor failed start-up test	Load cell/Analog Memory Board
11	Power-up	Ram Check Failed	Master Board
17	Manual / Testing	Trying to start test with interlock open	-
18	Testing / Jog	Interlock enabled while jogging	-
20	Manual Mode	Load cell ID not found in E squared	-
26	Manual Mode	Attempting a test with invalid specs	-
28	Manual Mode	Attempting a function that is not enabled	-
29	EP / Program Mode	EP or EO number not found	-
30	Program Mode / RS-232	Invalid memory location or EP number greater than 300	-
31	Program Mode / RS-232	EP or EO number less than 0, or entry less than min allowed	-
32	Program Mode	Memory location is greater than allowed but less than 300	-
36	Program Mode / RS-232	Printing, Sorting or Command not enabled	-
38	Communication	RS-232 device not detected	-
39	Communication	RS-232 timeout	-
41	Program Mode	Illegal key pressed in length offset	-

8.0 System Error Codes (continued)

UT Error Code Definitions			
Error Number	Error Type	Description	Componants Affected
42	Program Mode	Attempting to insert test point when at the max allowed	-
43	Program Mode	Attempting to delete a blank test point	-
51	Program Mode	Memory locations full	-
52	Program Mode / RS-232	Memory locations write protected	-
60	Program Mode	Length specified is less than zero	-
61	Program Mode	Length specified is greater than max.	-
62	Program Mode	Specified force is less than allowed	-
63	Program Mode	Specified force is greater than allowed	-
68	Program Mode	Rate test points not valid	-
69	Program Mode	Rate test points are the same	-
72	Program Mode	Preset or delay are less than zero	-
73	Program Mode	Force or length not specified for preset command	-
74	Program Mode	Initial tension is either less than zero length or greater than half length scale	-
75	Program Mode	Trying to exit program mode with no test loaded	-
80	RS-232	Inbound RS-232 communication improperly recieved	-
81	RS-232	Recieved "XG" Command via the RS-232 port	-
82	RS-232	Sum check incorrect when sending RS-232 with sum check values	-
86	RS-232	RS-232 command not recognized	-
87	Working Limits	Platform below lower limit	-
88	Working Limits	Platform above upper limit	-
90	RS-232	EP number not found	-
91	RS-232	RS-232 request for force or length from wrong mode	-
95	Testing	Free length time out	-
96	Testing	Test stopped by user with jog switch	-
98	Abort	Abort test	-
99	Testing	Movement not detected	-

9.0 Warranty Information

The LSI testing system parts and labor are warranted against defects in material and work- manship to the consumer for a period of one year from the date of purchase.

This warranty covers all parts except consumable items. It applies only to machines and accessories which have been installed and operated in accordance with instructions in our reference manuals, have not been tampered with in any way, misused, suffered damage through accident, neglect, or conditions beyond our control and have been serviced only by authorized personnel.

Larson Systems Inc. is not responsible for loss in operating performance due to environmental conditions, such as humidity, dust, corrosive chemicals, deposition of oil or other foreign matter, spillage, or other conditions beyond our control.

There are no other warranties expressed or implied, and Larson Systems Inc. shall not be liable under any circumstances for incidental or consequential damage.

Procedure for warranty service

1. Request an RMA number from Larson Systems Inc.

2. Ship the tester freight prepaid to: LARSON SYSTEMS INC.
10073 Baltimore Street NE
Minneapolis, MN 55449-4425
Phone: 763-780-2131
Fax: 763-780-2182

Note: Any shipment sent freight collect will be rejected.

3. Warranty determination will be made at the factory. Warranty service will be processed promptly.

4. The tester will be returned freight prepaid per LSI's current shipping procedures.

On site warranty repair service is available at a minimal cost. The customer is responsible for the travel expenses incurred. On site warranty repair service is only available within the continental U.S.A.

Model Designation _____

Serial Number _____

Date of Receipt _____

Larson Systems Inc.
10073 Baltimore Street NE
Minneapolis, MN 55449-4425
www.larsonsystems.com

763-780-2131
1-877-780-2131
Fax: 763-780-2182
info@larsonsystems.com